PUBLIC WORKS

Devoted to the interests of the engineers and technical officials of the cities, counties and states

JULY, 1937

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TIMEWASTERS

The Uphill Problem:

A couple of months back we had the problem about the path, built on a 5% grade around a cone 160 feet in diameter at the base, and 200 ft. high. Of course the horizontal projection of the distance was 4,000 ft., and the actual distance on a slope about 4,005 ft. Now Mr. Bevan suggests, as an A1, high class timewaster, that we find the length of the pathway, assuming that it rises 5 feet vertically every time it makes one revolution around the cone.

Mr. Clockwatcher:

Mr. Clockwatcher left for lunch, noting the time on his watch. He returned from lunch and again noted the time. He discovered that the hour and minute hands were in exactly the same places, except that they had exchanged positions. What time did he go and when did he return? From McWane Cast Iron Pipe Co., via *Fred D. Price.*

Lucky Man:

W. V. Brumbaugh writes to say that he could solve that microbe problem that appeared back in October, and he therefore judges we must be hard up for material. He submits: A man found that he owned twenty-five pairs of black socks and twenty-five pairs of blue socks. Through carelessness, the socks were all mixed up in his dresser drawer. If the man were blindfolded, what is the least number of socks he must take from the drawer in order to be sure of having a pair that matched?

Comments:

Much interesting and enjoyable material comes to the "Timewasting Editor," as one man put it. A letter from Mr. Vinson was particularly enjoyed; this was enclosed with beautiful solutions of Mr. Blunk's "Back to the Land" problem ($278,784 for 1,742.4 acres) and Mr. Bevan's "To the Coronation" (A was 25 miles ahead of B). Also a much appreciated letter from Major Steele down in Oklahoma, who feels we all need mathematical typewriters to work on these things; and other letters and notes too numerous to be listed. Major Steele says the bridge the cow got caught on was 59 feet long.

Off to camp this week-end, to work at being a reserve officer for 14 days. Perhaps a shower of contributions will be waiting when we return. W. A. H.

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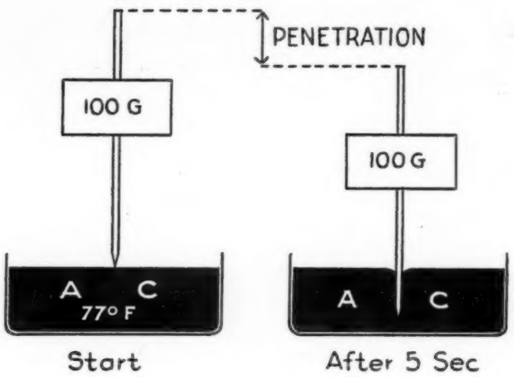


Fig. 3 Normal Penetration

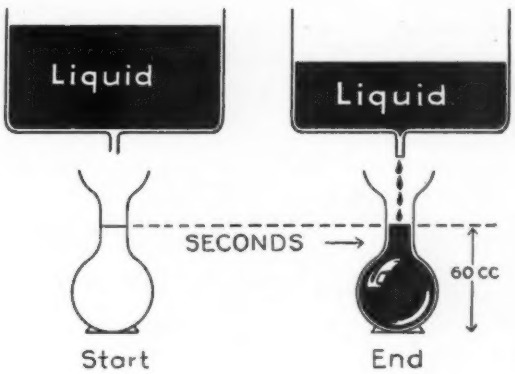


Fig. 4 Viscosity

Tests for Asphaltic Materials and Pavements

A Pocket Reference Manual for highway engineers has been published by the Asphalt Institute. The material below, which comprises a part of Chapter III of that manual, is published here because it is a simple and clear presentation of the various necessary tests for asphaltic materials; and it also shows our readers the type of material contained in that booklet. This is published through the courtesy of the Asphalt Institute. Illustrations are from the original text, a review of which will be found in the rear of this issue.

Consistency.—Control of consistency of an asphaltic material is important from the standpoint of its suitability as a constituent of the finished road or pavement and of its adaptability for use according to a given method of application or manipulation. The consistency of semi-solid products — asphalt cements — is determined by the penetration test. The original consistency of liquid asphaltic products is determined by a viscosity test; and the consistency of residues which may be expected to develop by volatilization of the lighter constituents of liquid products under service conditions is determined by the penetration test if the residue is semisolid or by the float test if the residue is liquid.

Penetration.—The penetration test determines the hardness of an asphalt cement by measuring the distance that a standard blunt pointed needle will vertically penetrate a sample of the material, under known conditions of temperature, loading and time. When other conditions are not specifically mentioned, it is understood that a penetration value or measurement implies that the material is tested at 77°F., that the needle is loaded with 100 grams and that the load is applied for 5 seconds. This is known as normal penetration. The unit of penetration is 1/10 millimeter, about 1/254 inch. It is, of course, evident that the softer the asphalt cement the greater will be its number of penetration units.

By means of penetration limits, asphalt cements are classified into grades on the basis of consistency. The Division of Simplified Practice of the U. S. Bureau of Standards has established the following grades which have been widely adopted for the different classes of asphalt highway work.

Grades of Paving Asphalt Normal Penetration Limits

(77°F., 100 g., 5 sec.)

25–30	50–60	85–100
30–40	60–70	100–120
40–50	70–85	120–150
		150–200

Viscosity.—The viscosity test determines the fluidity

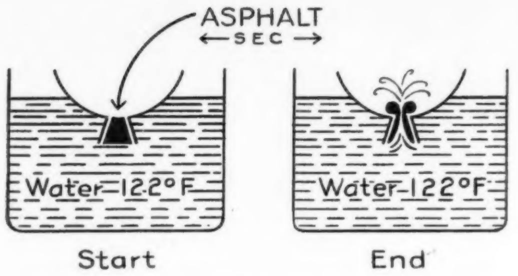


Fig. 5 Float Test

of liquids and, in the case of liquid asphaltic products, is a measure of their resistance to flow. Determination of viscosity is made with a standard instrument known as the Furol Viscosimeter and results are expressed as Furol Viscosity. The test is made at any specified temperature by recording the time in seconds for 60 cubic centimeters of the product to flow through a tube of standard dimensions into a measuring flask. The longer the time required the higher is the viscosity of the asphaltic product and the closer is its approach to the consistency of a semisolid.

While it would be highly desirable to express viscosity of all liquid asphaltic products at the normal temperature of 77°F., just as normal penetration of asphalt cements is expressed, no standard viscosimeter has been designed which can do this over the wide range of viscosities of the various liquid asphaltic road materials. The viscosity of an asphaltic product decreases as its temperature is raised and for those which are of higher viscosity at 77°F., than can be accurately measured by the viscosimeter, it becomes necessary to make the test at an elevated temperature. The temperatures most commonly used are 77°F., 122°F., 140°F., and 180°F.

Float Test.—The float test is a modified viscosity test adapted for use with small quantities of very viscous asphaltic products. It is a measure of the time required for a small plug of the chilled material, which is held in an open mold attached to the bottom of an aluminum saucer, to become sufficiently fluid, when the saucer is floated in water at 122°F., to permit the water to break through into the saucer. The apparatus and procedure for making this test have been standardized. Before making a test the asphaltic product is first cooled to a temperature of 41°F. so that it will not flow out of the mold.

Ductility is the distance in centimeters that a standard briquette of asphalt cement will stretch before breaking. The minimum cross section of the briquette is 1 square centimeter. The normal ductility test is made with the asphalt cement at a temperature of 77°F., and the rate of pull, or separation, of the two ends of the briquette is 5 centimeters per minute.

Flash Point.—The flash point of an asphaltic product is the temperature at which, during heating, its evolved vapors will temporarily ignite or flash when a small flame is brought in contact with them. Two types of flash testers are commonly used in connection with asphaltic products. For cut-back asphalts, which may flash at relatively low temperatures, the Open Tag Cup is used and for higher flash point products, the Cleveland Open Cup. While the design of these two instruments differs the basic operation of the test is the same for both.

The flash point of a product represents the critical temperature at and above which suitable precautions should be taken to eliminate fire hazards during its heating and manipulation.

Distillation.—The distillation test is applied to liquid asphaltic products, other than emulsions, to determine the amount and character of asphaltic residue which they may be expected to develop by volatilization of their lighter constituents under conditions of application and use, also the relative rapidity with which such residue will be developed.

The test is made by placing a measured volume of material in a distillation flask connected to a condenser and gradually heating it to a temperature of 680°F. Volatile products which are driven off are condensed and collected in a graduated receiver so that the volume per cent distilled at any desired intermediate temperature, as well as the end temperature, is readily indicated.

After distillation is completed the residue remaining in the flask is subjected to a consistency test and a test for solubility in carbon disulphide. If it is a semisolid and its penetration can be determined, it is also tested for ductility.

The distillation test in connection with a consistency test on the residue readily classifies the type of liquid asphaltic product under examination. If the residue is too soft for a penetration test the product may be classified as slow curing. If, however, the residue is sufficiently solid for a normal penetration test, the product is a cut-back asphalt. In such case if more than half of the total distillate comes over at a temperature of 437°F., the product may be classed as rapid curing while if considerably less than half of the total distillate comes over at this temperature, it should be classed as medium curing.

Solubility in Carbon Disulphide (Bitumen).—In an asphaltic product, bitumen is that portion which is completely soluble in carbon disulphide, CS_2. In asphalt cements and viscous residual asphaltic products solubility in CS_2, represents the active cementing constituents of the product. Asphaltic products properly refined from petroleum, without admixture with other materials, are at least 99.5% soluble in carbon disulphide.

The test for solubility in CS_2 is made by treating a weighed sample of the material with an excess of the solvent. The solution is then filtered to remove any insoluble material which may be present, after which the insoluble material is dried and weighed. The per cent insoluble is next calculated and this value subtracted from 100% gives the per cent soluble in CS_2.

Water and Sediment.—This test is made only upon liquid asphaltic products of the slow curing type. A measured volume of the material with an equal volume

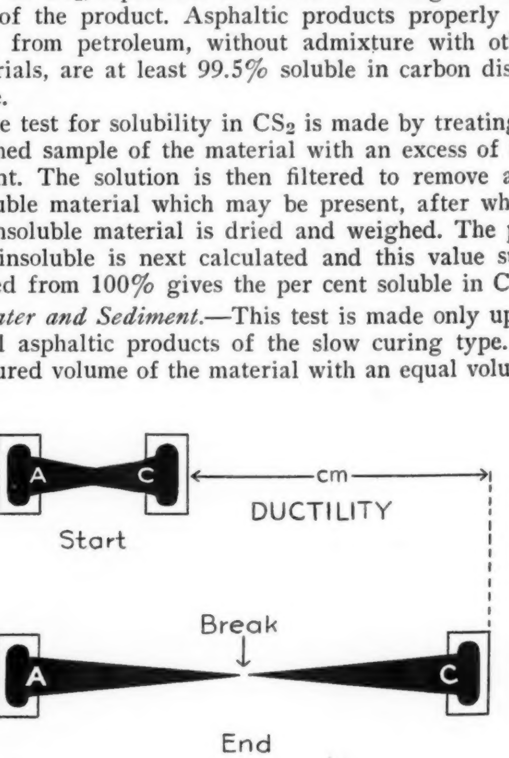


Fig. 6 Ductility Test

of benzol is placed in a special tube. The benzol acts as a solvent and thus produces a solution of low specific gravity and viscosity. The mixture in the tube is brought to a temperature of 120°F. and then whirled for 10 minutes in a centrifuge at 1400 to 1500 r.p.m. Any water and sediment that may be present collects in the bottom of the tube which is greatly constricted and graduated for close volume readings. The volume of water and sediment is read off and calculated on a percentage basis of the volume of original material.

Slow curing liquid asphaltic products are usually specified to contain not more than 2% of water and sediment.

Specific Gravity is the weight of any volume of a material divided by the weight of an equal volume of water. Thus, a specific gravity of 1.05 means that the material is 1.05 times as heavy as water. All liquids and most solids undergo noticeable changes in volume with changes in temperature. They expand when heated and contract when cooled. In order to indicate definitely conditions applicable to a given specific gravity value the temperature of the material and the temperature of the water should be shown. Thus, Sp. Gr. 60°/60°F. means that the determination has been made upon the basis of equal volumes of the material and water both of which are at 60°F.

Determination of the specific gravity of asphaltic products is of value as a means for making volume corrections when measuring them at elevated temperatures (225) and as one of the factors in the determination of percentage of voids in compressed asphalt paving mixtures.

A section is here devoted to the testing of mineral aggregate, including mechanical analysis, per cent of wear, weight per cubic foot, specific gravity, moisture, field moisture equivalent, and linear shrinkage.

Asphalt Paving Mixtures

Bitumen.—The per cent of bitumen in an asphalt paving mixture represents the amount of active asphaltic binding medium present in the mixture. It is determined in the same general manner as described for asphaltic products, although special extraction or filtering equipment is usually employed. In the test, all of the bitumen is dissolved in carbon disulphide, or

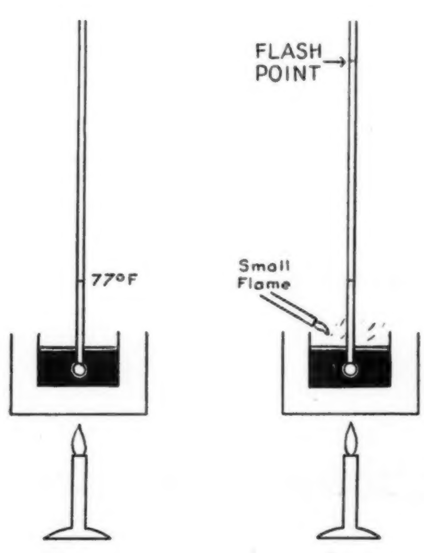


Fig. 7 Flash Test

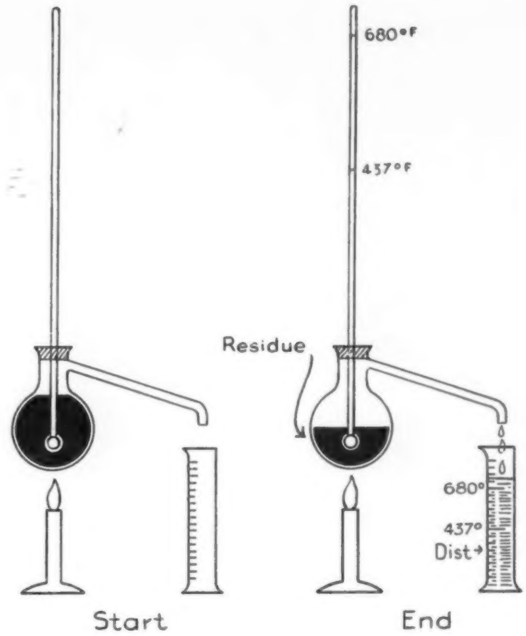


Fig. 8 Distillation Test

other solvent, and is sometimes recovered for further examination by evaporating or distilling off the solvent. The mineral aggregate which has been separated from the bitumen is frequently subjected to mechanical analysis.

This test is of value in determining whether or not a paving mixture conforms with specification requirements for composition. Determination of per cent bitumen, per cent mineral aggregate and specific gravity of both recovered bitumen and aggregate are necessary in calculating voids in compressed paving mixtures.

Specific Gravity.—The specific gravity or density of a compressed asphalt paving mixture is determined by weighing a sample of the compressed mixture or pavement in air and in water. The difference between these two weights gives the weight of an equal volume of water. If d represents specific gravity, A, the weight of sample in air, and B, the weight of sample in water, then specific gravity is calculated by the following formula:

$$d = \frac{A}{A-B}$$

Determination of specific gravity is a necessary step in the determination of per cent voids in a compressed asphalt paving mixture.

Voids in Compressed Mixtures.—The per cent of voids in a compressed mixture may be readily ascertained from its specific gravity if the specific gravity and weight per cent of both asphalt and mineral aggregate are known. Before this can be done, however, it is necessary to find out what the specific gravity of the same mixture would be if it were free from voids. This value known as "theoretical maximum density" is determined by the following formula in which D is the theoretical maximum density, W and W^1 the per cent of mineral aggregate and asphalt respectively and G and G^1 their respective specific gravities.

$$D = \frac{100}{\frac{W}{G} + \frac{W^1}{G^1}}$$

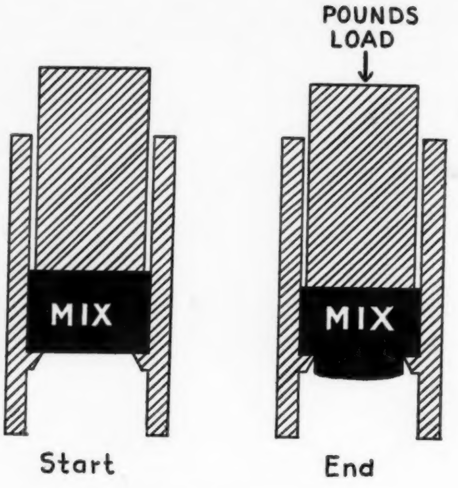


Fig. 9 Stability Test

The actual specific gravity "d", of the compressed mixture having been determined, the per cent voids "V" may be determined as follows:

$$V = \frac{100\ (D-d)}{D}$$

Voids in compressed high type asphalt surface course mixtures containing a dense graded mineral aggregate should not exceed 6 per cent.

Stability Test.—The stability test is a measure of the resistance to internal displacement possessed by a compressed asphalt paving mixture. In this test a compressed cylindrical briquette of the paving mixture, or core specimen taken from the pavement, is heated to 140°F. and placed in a close fitting cylindrical mold with a circular bottom orifice of standard diameter. A two inch mold is ordinarily used for sheet asphalt and similar fine aggregate mixtures, while a six inch mold is used exclusively for coarse mixtures. The orifice for six inch specimens produces the same stability values for sheet asphalt mixtures as the two inch mold. The maximum load developed in forcing the mixture through this orifice is recorded in pounds as a measure of the stability of the mixture. The test is made at 140°F. as this represents the maximum temperature which the mixture is likely to reach under service conditions. It has been found that high compression of the mixture is a most important factor tending to produce high stability and the importance of thorough compaction during construction is thus clearly indicated. It has been found that increasing amounts of mineral filler produce increase in stability up to the point where further additions of filler fail to further reduce the percentage of voids in the compressed mineral aggregate, provided the percentage of asphalt is kept within proper limits. Many other factors affecting stability have been investigated by means of this test.

The stability test is of value in determining the resistance to displacement under traffic of asphalt paving mixtures prepared for use and of asphalt pavements as laid. It is also of value in developing the most suitable formula or percentage combination of constituents to adopt for paving plant operation. A minimum stability of 2,000 pounds has been found sufficient to resist displacement under heavy concentrated traffic. Above this value, excessively high stability may, however, be conducive to cracking of the mixture under service stresses. For detailed description of stability test see Asphalt Institute Research Series No. 1.

Swell Test.—Mineral aggregate is encountered occasionally which has greater affinity for water than for asphalt. Such aggregate is termed "hydrophilic" and may cause trouble if present in a mixture subjected to severe water action. The action of water on compressed dense graded mixtures containing hydrophilic aggregate causes the mixture to expand.

The use of the swell test is usually limited to mixtures of dense graded aggregates with liquid asphaltic materials. A compressed cylinder of the mixture weighing 1000 grams and held in a close fitting 4-in. diameter metal mold, open at both ends, is placed in a water bath so that the bottom of the specimen rests on an open screen frame and the top is covered with water. The amount of swelling which occurs due to absorption of water is measured by means of a measuring dial attached to a rod which makes contact with the top of the specimen through a thin metal plate. Readings of the dial are taken until maximum swelling is obtained.

A swelling as little as 1/16 inch indicates a mediocre mixture, while entirely unsuitable mixtures from a service standpoint may swell as much as ¾ inch under the conditions of test. For detailed description of Swell Test see Asphalt Institute Manual No. 1.

AUTHORITATIVE METHODS OF TEST AS COMMONLY SPECIFIED

Asphaltic Products

Penetration, A.S.T.M. Standard Method D 5-25.
Furol Viscosity, A.S.T.M. Standard Method D 88-33.
Float Test, A.S.T.M. Standard Method D 139-27.
Ductility, A.S.T.M. Standard Method D 113-35.
Flash Point (Cleveland Open Cup), A.S.T.M. Standard Method D 92-33.
Flash Point (Open Tag) Method approved by the Bureau of Explosives—See the Asphalt Institute Construction Series No. 6, p. 13.
Distillation, A.S.T.M. Standard Method D 402-36.
Solubility in Carbon Disulphide (Bitumen), A.S.T.M. Standard Method D 4-27.
Water and Sediment. A.S.T.M. Standard Method D 96-35.

Mineral Aggregates

Per Cent of Wear of Rock, A.S.T.M. Standard Method D 2-33.
Weight per Cubic Foot of Broken Slag, A.S.T.M. Standard Method C 29-27.
Field Moisture Equivalent of Material Passing 40-Mesh, A.S.T.M. Tentative Standard Method D 426-35T.
Linear Shrinkage of Material Passing 40-Mesh, A.S.T.M. Tentative Method D 427-35T.
Screen Test of Coarse Aggregates, A.S.T.M. Standard Test D 18-16.
Sieve Test for Sand and Mineral Filler, A.S.T.M. Standard Test D 7-27.
Screen and Sieve Test of Mixtures of Coarse and Fine Aggregates, A.S.T.M. Standard Method D 19-16.

The information on testing of mineral aggregates, mentioned on page 12, was omitted because of space requirements. This will be sent to any reader on request.

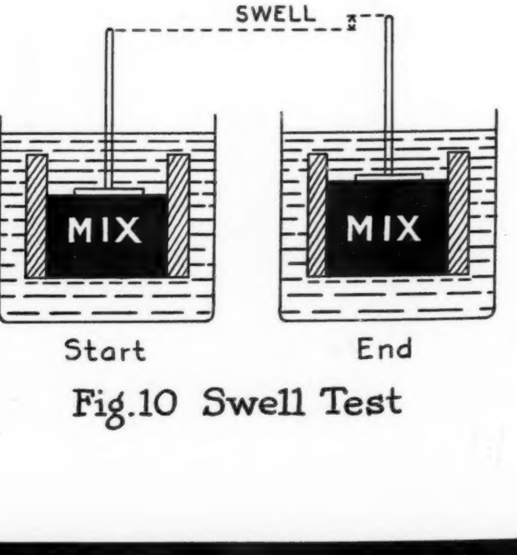
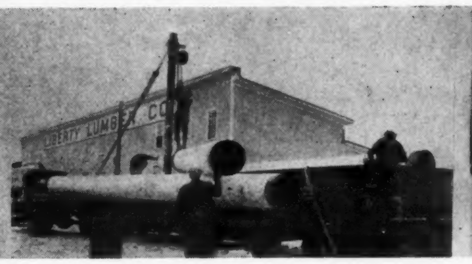
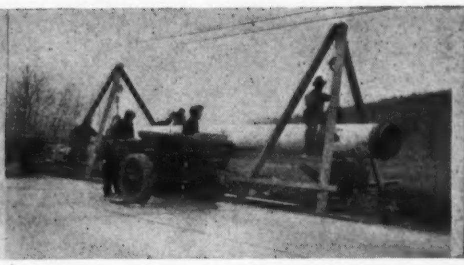


Fig. 10 Swell Test


Crossing under concrete pavement

Unloading pipe from cars

Placing pipe in trench

Laying in sidehill cut

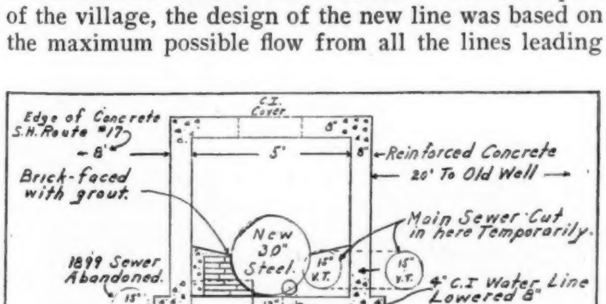
Steel Pipe for Trunk Line Sewer

By OLNEY BORDEN

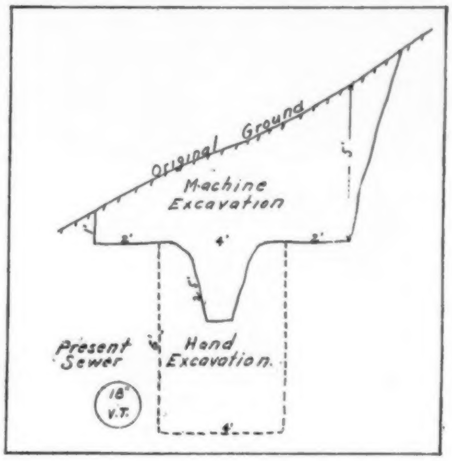
DURING heavy storms and sometimes during wet periods when the subsoil became saturated with water, the old sewer line serving as an outfall for the Village of Liberty, N. Y., was unable to carry the flow and backed up into cellars and overflowed through the manholes. In addition, the line permitted a great deal of infiltration, which added to the difficulty of properly treating the sewage, and also to the cost, since chemical treatment is used during a part of the year.

This old line was of 15-inch vitrified clay, laid in 1910 to replace a 15-inch line laid in 1899. A survey of the 15-inch line made in connection with preliminary investigations for the new sewer revealed a number of reasons why it was unable to carry the flow of sewage. At one manhole, the entering line was 1.10 feet lower than the outgoing line; at another manhole the inlet was 0.5 ft. lower than the outlet line. Also, the irregularities of grade and of alignment were such as to make it rather a source of wonder that the line had performed as well as it did.

Although considerable work has been done by the village in order to reduce the amount of storm flow coming into the sanitary sewer system, and all known roof connections, street drains, etc., have been eliminated, there is still a considerable increase in the amount of flow during storms. Inasmuch as the new line was constructed primarily to eliminate flooding of cellars and overflows from manholes in the lower part of the village, the design of the new line was based on the maximum possible flow from all the lines leading into the trunk. That is, its capacity is based on the volume of flow that will be obtained with all tributary lines discharging at capacity.



Manhole and Pipe Location



Right: Machine and hand excavation

Proceeding on this basis, the new outfall consists of 1460 feet of 18-inch line laid on a grade of 2.12%; 1820 feet of 24-inch line, with a grade of 0.564%; and 2440 feet of 30-inch with a grade of 0.1732%.

The line follows heavily traveled Route 17 for the greater part of its distance. A third lane will be added to this highway within a year or so, and a considerable part of the sewer line will be under this third lane. For about 1500 feet, where the road parallels an old lake, vibration from heavy truck traffic is considerable. For practically its entire length, the line lies in soil which contains ground water over a major part of the year.

It was therefore necessary to use a pipe which would be tight, to prevent infiltration, and would also be unaffected by severe traffic vibration. Steel pipe was selected, with Dresser couplings, and the contract was awarded to the Shelt Co., Elmira, N. Y., for Armco spiral welded pipe coated inside and out with bitumastic enamel.

Construction Methods

The work was done by the village board, by force account, and without the use of relief labor. For excavation along the 30-inch section of the line, which was laid along a sidehill and involved considerable excavation, a 3/8-yard gas shovel was rented from a local contractor and used for taking off the top four or five feet of the dirt, the bottom excavation then being removed by hand, as shown in the accompanying sketch.

The excavation done by this method through wet ground and also through 350 ft. of red shale rock which had to be taken out with a compressor, cost $1.15 per cu. yd., and backfill $.35 per cu. yd.

John Lawrence, superintendent of public works, under whose direction the work was done, worked out a scheme for handling the 30-inch pipe, a 40-ft. length of which weighs approximately 3000 pounds. Two tri-

Left, constructing Dresser joint, highway at left; center, every effort was made to save shade trees; right, where the new line crossed the old (see text)

pods were built with 12-ft. legs and two chain hoists hung from their tops. Composition belting was cut into 12-ft. lengths and the ends folded back and riveted to form a slot for a steel pin to be slid in. A cut was made in the center of the slot for a link of the chain to fit into, and the pin slid through this chain link. A belt of this type saves a lot of patching of the outside coating on pipe which would have to be made if chains were wrapped around the pipe. The pipes were lowered into the trench and each length was set to grade of nearest 1/16" with a transit, and then blocked for exact grade and line.

The 30-inch pipe was shipped in gondola cars, nine 40-ft. lengths to a car. In unloading, the pipe was raised by a belt around the middle and swung around and onto the truck and trailer. As the haul was less than one mile, only one length was hauled at a time.

The grade of the bottom of the excavated trench had to be checked carefully, because if there were high spots along the 40-ft. length, the pipe would rock on them and digging out these high spots is expensive after the pipe is once in the ditch. If, on the other hand, the trench is too low, the pipe has to be blocked in several places. We found that it paid us to check the grade all along the 40-ft. section just before the pipe was lowered into the ditch, to be sure that the trench was on grade. A long section of this pipe was partly backfilled when laid, and several weeks later was found to be within ⅛ inch of the true grade at every point.

The Dresser couplings and the section of the pipe near the couplings had to be coated after the couplings had been bolted into place, and bell holes were dug in the trench every 40 ft. to allow the men to bolt the couplings and put on the coating. All of the bell holes on the 30-inch line filled with ground water to a point about 3 inches up on the pipe, and a small Jaeger self-priming pump mounted on a wheel barrow frame kept the water down in these bell holes while the couplings were being bolted tight and coated.

The new 30-inch sewer line crossed the old one at one place and it was necessary to leave out one 40-ft. length for some time. This length was later set in place and the joint was made by cutting the flange of the coupling, spreading it and sliding it over the end of the pipe until the pipe was in place and then sliding the flange back into place and bolting it together the same as any other. The spot where the flange was cut was put on the top and well painted with the coating.

Fifteen manholes will be built along the sewer. The most practicable construction seemed to be to build them square, 5x5 ft. inside, using reinforced concrete for both top and sides, with a cover set in the top. The channels through the manholes were laid up with brick to one-half diameter of pipe and the brick faced with cement mortar to make a smooth surface. The space back of the brick channel was filled with second-class concrete and sloped up 3 inches above the top of the channel.

One manhole had a number of interesting complications, some of which are shown by the accompanying section through it at right angles to the pipe.

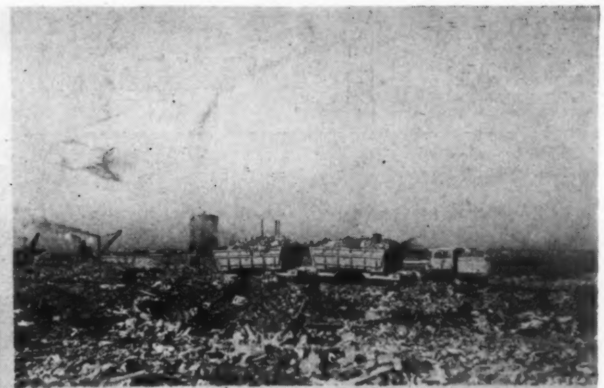
The main line of the sewer crossed the State Highway Route No. 17 at a point about one-quarter mile south of the Village limits. In order to avoid loss of flow due to sharp angles, it was necessary to cut through 100 ft. of the concrete. This was done, half-width at a time, and backfilled with R.O.B. gravel. One other crossing was made to cut in the main line of the present sewer, which was from 7 to 9 ft. below the concrete. This was done by tunneling under the concrete for 36 ft. This method of tunneling was more expensive than cutting through and replacing the concrete would have been.

To date, all of the 30-inch and about half of the 24-inch line has been completed. Because of the very heavy traffic on Route 17 during the summer months, the traffic delays incident to construction and the danger to the workmen from the passing cars, the work has been closed down and will be resumed after Labor Day.

Capacity of a Horizontal Cylinder

In our June issue, on page 24, was published an item illustrating the method of obtaining the capacity of a partly filled horizontal cylinder. In the illustrative example following the table, the diameter of the tank was assumed as 60 inches instead of 72 inches. The solution should therefore read:

A depth of 21 inches equals $21 \div 72 = 0.2917$ of the diameter of the tank. From the table, the factor for 0.2917 is 0.1905, by interpellation. The cross-sectional area of the filled portion of the tank is $6 \times 6 \times 0.1905 =$ 6.858 cubic feet.

Tractors Handle New York City Refuse at a Saving

THE largest refuse handling job in the country is at Rikers Island, New York City, where 15,000 to 25,000 cubic yards of material are handled daily, this consisting of almost all the refuse, including paper, boxes, bottles and incinerator residue from Manhattan, as well as the other boroughs in the city.

To be properly handled, a job of these dimensions requires a method that is economical, flexible, and that can utilize all possible space. The machinery in operation works in eight hour shifts, and is frequently called upon to operate twenty-four hours a day.

Refuse is towed out to the island on barges to one of the two unloading points. There it is unloaded by 10-yard orange-peel buckets, which are operated by steam driven derricks. These are arranged to load directly into the transporting units.

Until recently, the New York City Department of Sanitation employed a narrow gauge railroad for this work, the steam engine pulling a train of dump cars to the fill. With this method, however, as the fill progressed or as the dumping point was changed, it was necessary to re-lay the tracks. Moreover, this equipment had no way of compacting the fill, and as a consequence, considerable space was wasted.

Recently the steam railroad has been discarded and a fleet of diesel powered track-type tractors have been put on the job. This equipment has simplified and speeded up the work, in addition to increasing the economy of the operation. It also has permitted an increase in the amount of refuse which can be disposed of within a limited space.

The operation of the new units is simple and very flexible. Nine "Caterpillar" diesel RD8 tractors are on the job. Each hauling unit consists of one of these 95-horsepower machines, pulling two special 30-yard, hydraulically operated side dump Athey track-type dump wagons. The average haul is approximately 1,500 feet, although occasionally it is necessary to move the material as much as 3,000 feet. The loaded wagons are run as close to the edge as possible, depending upon the height of the fill, which governs the hazard and the distance from which they must dump.

The fill is kept in condition and the material bulldozed over the edge by other "Caterpillar" Diesel tractors, equipped with hydraulic bulldozers. All of the tractors on the job are equipped with hydraulic pumps that are interchangeable for bulldozer or wagon operation, enabling the machines to be switched from one job to another with a minimum of lost time.

It has been estimated that the new installation will save the City of New York many thousand dollars annually—probably $100,000—in both operating costs and upkeep of equipment. Moreover, the tractors and bulldozers, used as a compacting unit, have allowed the disposal of 25 to 50 percent more refuse within the same area since their installation.

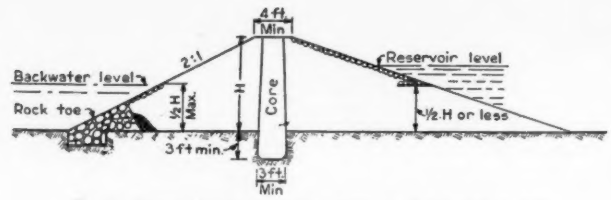


Fig. I Cross section of earth dams 12 feet high or less

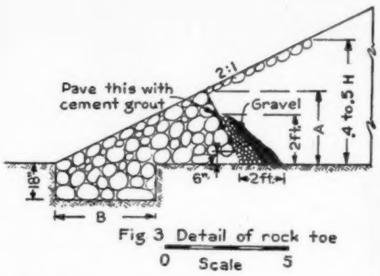


Fig 3 Detail of rock toe

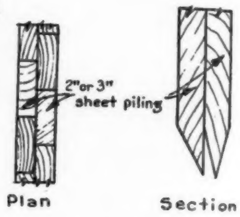


Fig. 4 Details of timber sheet piling.

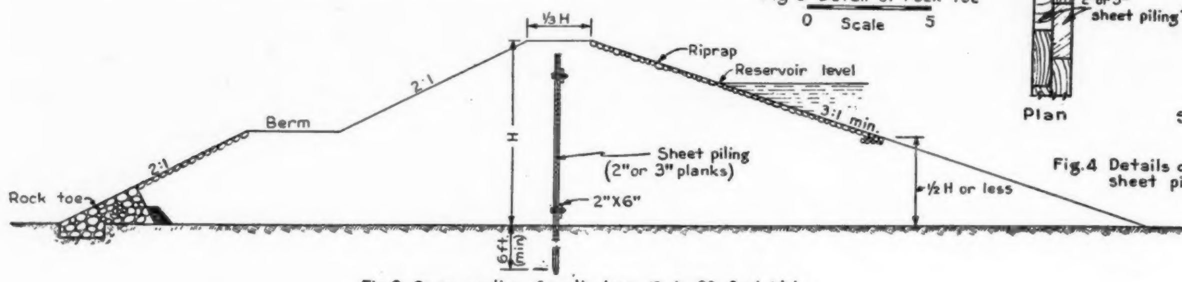


Fig. 2. Cross section of earth dams 12 to 20 feet high.

Instructions for the Design and Construction of Small Dams

Prepared by L. C. Tschudy and John G. Sutton, Engineers, U. S. Department of Agriculture, under the direction of Lewis A. Jones, Chief, Division of Drainage

THESE instructions cover the design and construction of dams suitable for Civilian Conservation Corps work in North Dakota, and data relating to runoff, spillway capacity, etc., should be used cautiously for work in other states. These instructions refer to dams not exceeding the following average heights above stream beds: earth dams, 20 ft.; rubble masonry dams, 10 ft.; timber crib dams, 8 ft. Dams described herein are intended primarily to store water for flood control and water conservation purposes and to raise the water table in bottom lands. No provisions have been made for draining the reservoirs.

General Instructions and Field Data to Be Secured

A topographic survey should be made of the dam and reservoir site and all spillway locations, and the following information should be obtained for design and estimating purposes:

1. Sufficient topographic information should be obtained from maps or surveys to estimate acre-feet of storage and watershed area.
2. A profile should be secured along the center line of the proposed dam extending across banks of stream to an elevation at least 3 feet above maximum height of dam, or a linear distance of at least 200 feet from the spillway location. Similar profiles at right-angles to the stream should be made at critical points upstream and downstream from the proposed dam.
3. High-water marks in the channel should be determined and elevations noted on profile. Discharge measurements should be made by use of a float, if the stream is flowing.
4. Borings should be made or test pits dug at 10 to 25-foot intervals along center line of dam to determine the foundation conditions. In no case should less than five borings be taken, to a depth equal to ½ to ¾ the height of the proposed dam.
5. The surface and subsurface soils of the proposed foundation of the dam, vegetative conditions, location of old channels, and geologic conditions that might affect the design of the structure, should be determined and accurately described.
6. Locations of construction materials, especially clay, sand, gravel, and rock, should be determined and quantities available and distance from site noted.
7. Investigations should be made to determine whether crawfish, muskrats, or other burrowing animals will probably be active.
8. Data should be secured showing factors affecting design, such as land ties, names of property owners adjacent to site, location of roads, low-water fords upstream, sewer outlets, and location of nearby farm buildings, houses or other improvements which might be affected by the proposed dam.

Design of Earth Dams

An allowance of approximately 10%—even 15% for some structures—must be made for the settlement of earth dams; for instance, a dam 20 feet high should be constructed at least 22 feet high. The heights referred to in this report relate to the finished cross-section after settlement.

The section which should be used for dams below 12 feet in height is shown in Figure 1 and the section to be used for a dam 12 to 20 feet high is shown in Figure 2. Details of construction are shown in Figures 3 to 6. The top width of a dam should be approximately one-third of the height, unless the top of the dam is to be used as a roadway requiring a top width of 8 to 12 feet. A minimum top width of 4 feet should be used. The upstream slope should be not less than 3 horizontal to 1 vertical, and the downstream slope not less than 2 horizontal to 1 vertical.

As a general practice for C.C.C. work, a berm should be placed on the downstream slope of all dams exceeding 12 feet in height where the top width does not exceed approximately one-third the height. The berm should be placed 6 to 8 feet above the bed of the stream

and its width should vary from 8 to 12 feet. The top of the berm should have a slight slope downstream.

The downstream slope of the dam should be protected with a rock toe and riprapped, as shown in Figures 1 and 2. Collecting drains may be used to drain the downstream face, to dry out wet foundations and prevent saturation of the downstream toe.

Protection for Earth Dams

If the reservoir covers more than about one acre of ground, the earth dam should be protected against wave action. For emergency conservation work in North Dakota the upstream protection generally should be confined to rock riprap, also to be placed on the downstream face of the dam, as shown in Figures 1 and 2. If no large stones are available and there is an adequate supply of coarse gravel, good protection can be obtained by placing a 12″ to 24″ layer of this material on the slopes of the dam.

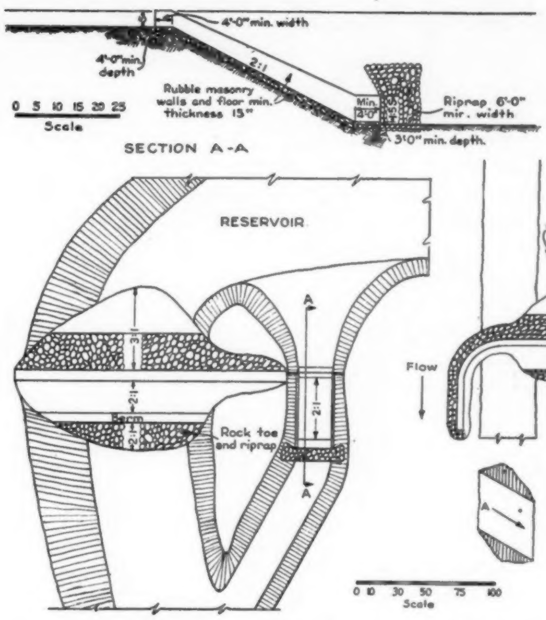


Fig. 5—Plan of excavated spillway and earth dam

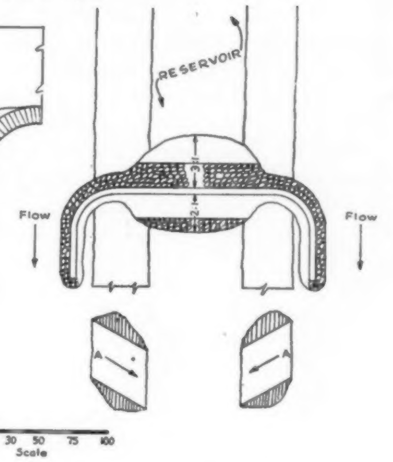


Fig. 6—Plan of earth fill with natural spillway

The type of protection necessary for the downstream face and toe of the dam depends upon the foundation, height of dam, and height and duration of backwater. A triangular ridge of rock having a height of 3 or 4 feet (see Figure 3) should be constructed. This rock protects the downstream toe from sloughing off. This protection is especially desirable where the stream will be diverted through the spillway into the channel below the dam and cause backwater eddies against the downstream toe of the dam. By paving the inside face of the rock toe, as shown in Figure 3, dirt from the dam will be prevented from washing down the slope and filling the rock voids. An opening of at least 6 inches next to the ground should be left without grouting in order to permit the seepage water to drain freely. The rock toe should be backfilled with gravel and sand to act as a filter, as shown in Figure 3, thus preventing any large amount of earth from washing through the toe.

Riprap should be laid on the downstream slope at least to the elevation which will be reached by normal spring flow. It is estimated that by placing riprap to an elevation of .4 H to .5 H an ample factor of safety is secured. Protection of the top of the berm with riprap may be required. When designing the spillway, an attempt should be made to deflect the currents away from the downstream face of the dam to minimize the effect of eddies. The drainage of surface water from the slopes of the dam and from adjacent banks should be planned so as to prevent erosion. Where considerable surface water is concentrated after rains, it is advisable to pave with rock the channels which it naturally follows. The top and downstream slope should be either sodded or seeded.

The dam should be fenced in, or livestock may roam over the dam and cause much damage to the structure.

Core Wall and Sheet Piling

Sheet piling may be required for earth dams less than 12 feet high for protection against burrowing animals. For dams below this height, where sheet piling is not required, a tamped core should be constructed of impervious clay, placed in position in thin layers, sprinkled with water, and carefully tamped in place by hand. (See Figure 1.)

For earth dams 12 to 20 feet high, wood sheet piling should ordinarily be used where the dam is endangered by burrowing animals. A double row of sheet piling extending up to the elevation of high water should be driven, using planks 2 inches thick if they can be driven; otherwise 3-inch planks. The planks should be staggered and securely bolted together. (See Figures 2 and 4.) If the foundation contains so many rocks and boulders that the sheet piling cannot be driven, it will be necessary to excavate a deep trench in which to set the piling, or some other type of core wall must be used, such as a rubble masonry, concrete, or clay puddle core, or steel sheet piling. If properly constructed, these types reduce seepage satisfactorily, are structurally safe, and all except the puddled clay type are effective against burrowing animals. The choice of type of core wall depends on its cost and on the location of the dam, the materials available, the cost and importance of the project, and the damage that would result in case of failure.

The effectiveness of the masonry type of core wall against burrowing animals as compared with the puddled clay type is a very important advantage if the dam will have only occasional inspection. A crack in the masonry wall is not attended by so much danger as a breach or puncture in a clay puddle core. The masonry wall is better adapted than the clay puddle to making connections with outlet conduits, rock or masonry abutments, or rock foundations. The puddled clay core is more flexible and is less likely to be ruptured by the unbalanced pressure in the dam than the more rigid masonry wall. A masonry core wall requires firm rock for the foundation or else the footings must rest on solid earth. Puddle construction requires the exercise of good judgment in the selection of materials and skill and care in the mixing and placing of them.

Puddled cores can often be used to advantage in low extensions of the dam on the banks of a stream. In projects where there is a knoll between the dam and the spillway, borings or pits should be used to determine whether sand or gravel strata exist which might weaken the structure. Where such strata exist, clay puddle cores or sheet piling should be carried across the knoll to break natural lines of seepage.

Foundation and Construction

The most suitable material on which to place an earth dam is clay containing a small amount of silt or sand. In preparing the foundation, all sod, brush, trees, roots, and other perishable matter should be removed from the entire area to be occupied by the dam, which material should not be used in the dam. Soft, mucky soil should be removed from the foundation. The entire surface should be plowed or scarified to insure a firm bond between the dam and the foundation.

If sheet piling is to be used, it may be driven along the center line of the dam without constructing a trench. It should be driven to a depth of at least half the height of the dam, and should extend through any pervious strata of gravel or sand. If deep strata of sand and gravel are encountered the site should be abandoned and a new site located. When a core of puddled earth is used instead of sheet piling, a trench should be excavated having a minimum width of 3 feet, and deep enough, should any stratum of gravel and sand be found beneath the site, to extend a minimum of 2 feet into the impervious stratum beneath.

The core trench should be backfilled with clay, with which a slight amount of sand may be mixed. The core should extend to the top of the dam, and be puddled if an abundant water supply is available. If water is scarce, the material selected for the clay core should be sprinkled and tamped firmly in place.

The stream banks which will be covered by the dam should be sloped and then scarified, the amount of slope depending on the soil. This will reduce the tendency to form shrinkage cracks along well-defined planes and produce more equal settlement.

The dam should be constructed from carefully selected materials; impervious sandy or gravelly clay which is firm when wet is considered the best material for dam construction. If there is not sufficient watertight material to construct the whole of the dam, that which is most watertight should be placed in the upstream and center sections of the dam, and the coarser materials placed in the downstream section.

The fill should be constructed in layers not over 12 inches thick. The layers should be placed to the full width at all levels. At the completion of each week's work a slight ridge should be constructed around the edge of the fill in order to collect any rain that may fall, which will help to settle the earth fill.

The travel of teams, wagons and scrapers over the embankment should be distributed to secure as thorough and uniform compacting as practicable. If this does not produce a firm, well compacted embankment at all points, the fill should be sprinkled with water if possible and rolled.

The rock protection for the downstream toe should be carefully constructed. Any large boulders and rocks encountered during construction should be used for this purpose.

All earth fills should be completed approximately one month before freezing weather is likely to occur, safety requiring that they be permitted to settle for at least this time before freezing.

Data on determination of spillway capacity, construction of spillway, and the design of masonry and timber crib dams will appear in an early issue.

Equipment in Constructing Little Rock Conduit

Building a pipe line 32 miles long to bring water from Alum creek to Little Rock, Ark., is not an extraordinary job in any way, but is an excellent example of the modern use of equipment in this class of work, and a statement of the equipment used may be interesting.

The contract was awarded last July to the Lock Joint Pipe Co. for reinforced concrete pressure pipe. This is made near the city in a plant with a capacity per day of fifty 16-ft. lengths of 39″ pipe, which has turned out nearly a mile a week. In this plant are used 11 300 ampere welding generator sets (Hobart and Lincoln), a Federal butt welder, a Rex mixer, Blaw-Knox 200-ton batcher and hopper, Rex vertical conveyor, American Hoist & Derrick Co. 25-ton locomotive crane, Ingersoll-Rand air compressor and a 45 hp. OWS Oil County boiler (for providing curing steam).

For delivering the pipe, contractor Stanley L. Evans uses four C40 Internationals and two 3-ton Dodges with flat-bodied trailers, and several Caterpillar tractors and wagons. For excavating trench, two Northwest hoe diggers (Diesel), two Caterpillar tractors for backfilling, two Caterpillar tractors carrying 300 cu. ft. air compressors and two Ingersoll-Rand derrick drills.

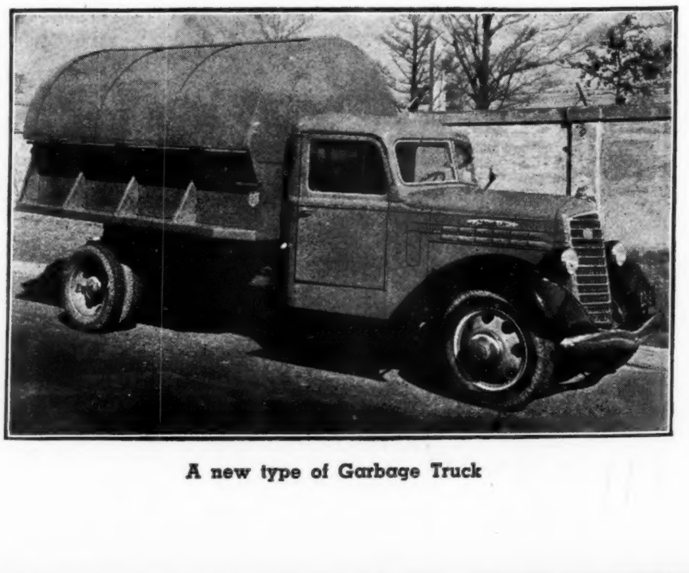
In driving two tunnels totalling 2500 ft. Salmon & Cowin use Ingersoll-Rand mounted jackhammers, and the 24″-gauge mine cars are lifted 25 ft. to the surface by Ingersoll-Rand utility air hoists.

Burns & McDonnell are the engineers for the work.

A Modern Means for Removing Refuse

This new truck, designed for removing refuse efficiently and economically has a body 10′6″ long x 5′6″ wide with 15½″ straight sides. This gives a body capacity of three cubic yards. Equipped with flared sides about 10″ high which are bolted on, and covered with a special sliding cover with three sliding doors on both sides, the body capacity is increased approximately six cubic yards. The flared sides and body cover are easily removable, thus reducing this unit to a standard dump unit.

This truck is a Mack Jr. rear end dump type. The cover on it is equipped with a top hinged tail gate which permits easy discharge of refuse. The covers are in three sections and therefore the left hand covers can be turned all the way over to the other side and vice-versa. It can also be noted that the doors open on either side.



A new type of Garbage Truck

The Editor's Page

Sanitation for Trailers

Right now the matter of sanitation for trailers requires some thought and consideration. Will it become necessary to provide special sanitary facilities for these, and who will pay for them? Many of the trailer camps are on the outskirts of cities or villages; often beyond the reach of sewer facilities. In some cases, small sewage treatment plants will have to be constructed to service these trailer camps.

The design of these will not be easy. For what volumes of flow should the plant be designed? This will depend, probably, on the water pressure and water use at the site of the camp. The degree of treatment required will depend upon local conditions. Another interesting factor is that such camp use will be seasonal, and except for a relatively few months in the year, the plant may not be in operation. Therefore the design must be such that efficient operation will be possible even with small flows and after a period of complete rest. Also the plant must not be a nuisance when it is not in operation.

Perhaps the need for trailer camp sanitation will bring a new interest in small sewage plant design. Certainly there is need for a new viewpoint in this field, and also in the field of sewage treatment for summer camps. We should be glad to hear from any of our readers who have thought seriously on this subject.

Some Observations on the Chemical Treatment of Sewage.

Chemical treatment of sewage appears to be gaining favor of late—we might say again, for there was a period when it was in high favor, followed by many years when progress in it slowed down to somnolescence. Part of this advance is due to added experience and part to the continuous study and research that has been carried on. A notable development of the past year or two is the recognition that aluminum sulphate has an important place in this field. This recognition has been slow in coming; first results attained with alum were questioned or even taken lightly. It now seems to be pretty well established that in many plants alum will coagulate sewage satisfactorily and economically, perhaps even better than any other chemical.

One factor whose importance is just beginning to be recognized in chemical coagulation is the influence of supernatant liquor from the sludge digestion tank. The strength of this affects coagulation materially. In some plants this overflow is very strong, in others weak. When the supernatant is returned to the inlet of the settling tank, it may have a very considerable effect on coagulation and on the amount of chemical required for satisfactory coagulation. It may prove economical in plants where the supernatant is strong to segregate this and to treat it separately. In most cases, this can be done without serious difficulty or trouble.

Methods of treating the supernatant are now being developed, and good results have been obtained. From this early work it appears that, though heavy dosages are needed for treating the supernatant, the chemical required for this purpose is very much less than the additional amount that would be required for coagulating the sewage from which the supernatant has not been removed.

Licensing Water Works Superintendents

Licensing men in technical or semi-technical positions is a comparatively new idea, but one which seems to be finding increasing favor. For purely technical positions, like operation of sewage and water treatment plants, there seems to be little opposition now among state health boards and others interested in efficient operation of such plants. The direct relation between public health and water purification makes an appeal to all citizens in the case of operators of water purification plants.

But for the superintendents of such plants the desirability is less directly apparent. The duties of superintendents of large plants are chiefly administrative, but in small plants they may have to operate directly the purification as well as the pumping plants. It would be interesting to learn what the superintendents themselves thought on this subject, and a national cross-section of such opinion is given in this issue. This indicates that, of those having positive ideas on the subject, three-fourths favor licensing. We hope all superintendents will read this article, and if any have further ideas on the subject we will be glad to hear from them.

The Late Harrison P. Eddy

Sanitary engineering on June 15th lost one of its leading figures in the death of Harrison P. Eddy. Mr. Eddy, who was 67 years old, died of heart attack in Montreal, where he was attending a meeting of the Engineering Institute of Canada, which was to confer on him honorary membership.

Graduating from Worcester Polytechnic Institute in 1891, he was appointed superintendent of the Worcester sewage treatment plant and later of the entire sewer department. During his 16 years in this position he so used his ability as to give prominence to the plant, which was visited by hundreds of engineers. He was therefore well known to the profession when, in 1907, he began private practice as member of the firm of Metcalf & Eddy. Since then this firm has become the most prominent eastern one specializing in sanitary engineering, having acted as consultant to nearly 100 cities from New England to Texas, including most of the largest ones.

There was nothing spectacular about Mr. Eddy's work; his high reputation was founded on the enduring basis of thoroughness of investigation, sound judgment in analysis, conservatism in his recommendations, but with an open mind for new ideas; and through it all, the scientific honesty which is guided by facts and never by prejudices.

His friendships, both given and received, were sincere. In his business relationships he was respected and honored by all. He gave abundantly of his valuable services to his profession through the several technical societies, two of which had elected him as president. He exerted an important influence in elevating the ethics of the profession. In every way, sanitary engineering suffers a great loss in his death.

State Highway Programs for 1937

Funds Available and Construction Mileage by Types

Compiled by the American Road Builders Association

	FUNDS AVAILABLE FOR STATE HIGHWAY CONSTRUCTION							CONSTRUCTION MILEAGE BY TYPES					
	State Funds	Regular Federal Aid	Works Program Funds	Other Federal Funds	Maintenance Funds	Miscellaneous Funds	Expenditures for Equipment	Earth Improved	Sand, Clay, Gravel, Macadam UNTREATED	Sand, Clay, Gravel, Macadam TREATED	Asphalt	Concrete	Other Hard Surface
Alabama	$ 2,200,000	$ 5,208,287	$	$	$ 2,000,000	$	$ 300,000						
Arizona	2,000,000	2,300,000	200,000		1,400,000		200,000	30	60	75	6	5	25
Arkansas		4,275,929	2,065,978	20/ 2,625,302	3,000,000	16/ 893,403	200,000						
California	12,622,400	4,750,000		1/ 3,065,500	8,239,000		900,000	250	50	2/ 660	65	70	
Colorado	18,082,665	3,752,668	1,775,000		1,600,000		155,000	100	600	500	15	30	
Connecticut	10,725,000	800,000	1,200,000		2,873,160		405,825						
Delaware													
Florida	3/ 8,836,544	1,676,478	1,883,612		2,181,535								
Georgia													
Idaho	2,000,000	3,065,000	408,000		1,500,000		250,000						
Illinois	14,000,000	12,000,000	9,000,000	4/ 7,000,000	6,150,000		500,000	295	345	25	250		
Indiana	5,000,000	3,000,000			3,400,000		125,000						
Iowa	3,300,000	3,935,000	327,000		3,824,000		400,000						
Kansas	1,720,000	3,314,031			3,484,000	13/ 1,982,494	600,000	368	502	579		114	
Kentucky	5,325,000	4,698,386	1,085,147		4,500,000		400,000	226.9	53.7		72.5	110.4	
Louisiana	26,820,000	1,780,991			3,500,000		450,000						
Maine	3,879,861	2,754,861	150,000		2,500,000			55	640	20		260	
Maryland	4,647,203	2,051,740	5,182,402		3,464,784		270,800	30	100	174	32	3	
Massachusetts	5/ 1,948,738	4,601,501	892,639				236,200						
Michigan	4,400,000	4,400,000	1,250,000		5,000,000	16/ 1,664,807	400,000				27	151	
Minnesota	4,500,000	4,500,000	6,000,000		7,000,000		600,000	6/ 140				6/ 30	
Mississippi	34,374,159		2,937.709		2,000,000		75,000	400			700		7/ 25 - 150
Missouri	3,162,042	8,200,000	8/ 516,000		5,050,000		450,000	515	341	246		106	
Montana													
Nebraska													
Nevada					816,535		250,000	95		9/ 214.8			
N.Hampshire	2,382,025	609,375	375,000		2,920,350		69,500		20	125	3	1	6
New Jersey 10/													
New Mexico	11/ 1,305,248	2,247,529		12/ 408,137	1,203,500	13/ 840,428	300,000	4	145				76
New York	18,994,711	12,231,796	2,155,000		11,014,093		600,000	80		170	14/ 250	210	
N.Carolina	5,161,650	4,039,813	1,996,500		12,500,000	13/ 922,168	600,000	300	335		30	100	
N.Dakota		3,900,000	750,000		1,395,000		150,000	405	400	85			
Ohio	9,975,000	7,710,117			12,500,000		500,000						
Oklahoma	9,000,000	4,850,000	350,000		4,500,000								
Oregon	1,531,000	3,365,000	5,352,000		3,175,000		175,000	200	300	210	30	10	
Pennsylvania					30,000,000	21/ 33,000,000	1,000,000						
Rhode Island	1,019,000	609,375	1,275,695		1,262,000		50,000						
S. Carolina	3,000,000	2,000,000	2,000,000		1,700,000		225,000				5.3	4.2	1.3
S. Dakota	1,000,000	3,000,000	2,159,000		1,750,000		94,000	150	250	15/ 200		30	
Tennessee		3,167,611			3,000,000		225,000						
Texas	10,000,000	7,771,317			9,000,000	16/ 975,994	350,000	549	300		258	202	3
Utah	725,000	2,237,336	422,885		1,000,000		100,000						
Vermont		625,000				13/ 375,000							
Virginia	6,139,617	2,328,369	941,656		11,178,465	17/ 465,674	3,430,000						
Washington	3,500,000	2,002,877		18/ 275,000	2,393,000	16/ 767,991	120,000	5.1	139.07	551.74	4.1	45.93	31.53
W. Virginia	5,600,000	1,638,000	500,000		5,300,000		250,000						
Wisconsin	5,388,000	5,340,000	520,000		19/ 7,000,000	13/ 1,874,000			147			223	177
Wyoming	1,500,000	2,500,000			650,000		300,000	120		235			
TOTAL	$250,764,863	$153,236,387	$53,669,223	$13,373,939	$196,924,422	$43,761,959	$15,704,325	4,296.0	4,727.77	4,070.54	22/ 1,747.9	1,705.53	344.83 -150

(1) Other Federal funds.
(2) 290 miles low cost bituminous mix.
(3) Subject to 1937 Legislature.
(4) Other Federal-aid.
(5) 1936 Funds. Amount of additional funds dependent upon Legislative action.
(6) Under contract.
(7) Bridges.
(8) Carry-over from 1936.
(9) Includes 188 miles of oiling only.
(10) No appropriation or expenditure figures furnished.
(11) Additional State funds will probably be expended.
(12) (50-50 basis) subject to change.
(13) Grade crossing and secondary.
(14) Bituminous macadam.
(15) Oil treated.
(16) Grade crossing projects.
(17) Federal-aid Federal roads.
(18) Special maintenance ($743,000)
(19) Includes $1,500,000 for snow removal.
(20) Regular Federal aid if matched by State.
(21) Total construction funds State and Federal.
(22) Includes 950 miles asphalt & concrete.

Roads, with 38,239 Projects, Lead All WPA Activities

Top—Road camp near Portland, Oregon.
Bottom—Aerial view of farm-to-market road, Oklahoma.

THE grand total of all projects placed in operation by the Works Progress Administration as of December 31, 1936, was 121,240. This figure represents all work begun during the 18 months of the WPA's operations from the summer of 1935 to the close of 1936. During the same period, projects to the number of 73,146 were completed. Work continued in progress at the close of the year on 48,094 projects. Many of these have since been completed, accomplishment figures not yet being available. At the same time, hundreds of other new projects have been initiated since January 1, 1937, on which work is now in progress. Complete reports on the total of these new projects also are not yet available from the states. During this period, employment on these projects totalled 2,500,000 persons as a monthly average, with the peak of employment at 3,035,852 persons in February, 1936. In December, 1936, 2,192,409 persons were employed on WPA projects then in operation. In May, 1936, employment had dropped to 2,016,979 persons.

Of the 121,240 projects representing the grand total, 85,011 or 77.3 per cent involved construction work and 36,229 or 22.7 per cent embraced non-construction types of work. Among the 85,011 construction projects, 41,037 represent new construction and 43,974 were and are devoted to repairs and improvements. Work had been completed on 25,971 new construction projects as of December 31, 1936, while new construction projects continuing in operation numbered 15,066. On the same date, 29,369 repair and improvement projects had been completed while work continued in progress on 14,605 such undertakings. These figures do not take into account either completions or new projects initiated in 1937.

Among the WPA construction activities, projects devoted to highways, roads and streets constitute by far the largest number with a total of 38,239. Of these, 14,170 represent new construction and 24,069 repairs and improvements. New construction projects in this category to the number of 9,424 had been completed at the close of 1936, while 4,746 continued active. Repair and improvement projects which had been completed numbered 15,405 and 8,664 continued in operation. Of the total of 24,829 completed projects involving highways, roads and streets, 10,164 dealt with farm-to-market and other secondary roads; 233 involved primary highways; 5,556 composed operations on streets and alleys; 2,019 were for installation or repair of sidewalks, curbs, and paths; while 1,990 were for roadside improvements, 1,471 for bridges and viaducts, 14 for grade crossing eliminations, and 3,382 for other types of road and street work. Of the 13,410 projects in this classification still in progress, 6,013 were farm-to-market road projects. Of the balance, 177 involved primary highways; 2,529, streets and alleys; 786, sidewalks, curbs and paths; 752, roadside improvements; 516, bridges and viaducts; three grade crossing eliminations; and 2,634, miscellaneous work on roads and streets.

With the WPA road construction program in full swing, more than 700,000 persons of the total given employment have been at work on road projects. More than 120,000 miles of highways, roads and streets have been constructed, repaired and improved by the Works Progress Administration with this army of laborers, who were taken from the relief rolls and their energy and skill put to use in providing substantial local public works. Based upon the latest reports available from the state WPA offices, the following figures reveal the accomplishments of this vast labor force on highways, roads, streets, and related projects:

Bituminous or concrete roads, 2,454 miles new construction and 3,813 miles repaired or improved.

Brick or block roads, 267 miles new construction and 568 miles repaired or improved.

Dirt, clay, or gravel roads, 22,765 miles new construction and 61,453 miles repaired or improved.

Improvement of roads, 3,658 miles new construction and 27,614 miles repaired.

Road shoulders, 1,555 miles new construction and 18,838 miles repaired or improved.

Grade-crossing eliminations by relocation, 16 involving construction of 26 miles of roads.

Grade-crossing eliminations by construction of viaducts, six.

Bridges, 7,633 new construction and 12,953 repaired or improved.

Culverts, 85,811 new construction and 26,541 repaired or improved.

Sidewalks and paths, 2,540 miles of new construction and 1,972 miles repaired or improved.

Curbs and gutters, 7,936,922 feet of new construction and 3,721,208 feet repaired or improved, equipping 2,022 miles of roads and streets.

Bridge near Ooltewah, Tennessee

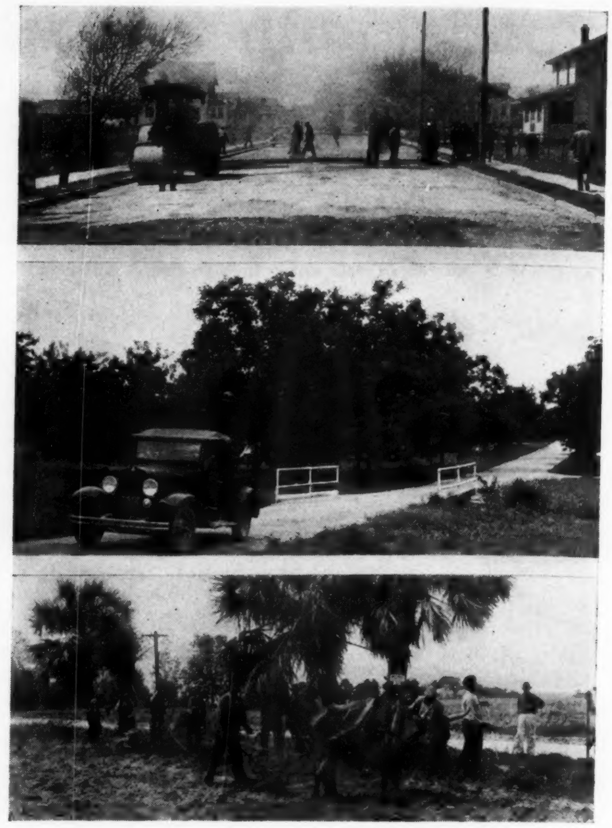
Roadside landscaping involving 8,731 miles of road and 25,702 acres of roadside.

Guardrails and guardwalls, 1,881,833 feet of new construction equipping 1,256 miles of road, and 1,997,547 feet of repairs or improvements equipping 799 miles of roads.

Lights for roads and streets, 3,007 new installations serving 61 miles of road, and 5,860 repaired or improved serving 309 miles of roads and streets.

Fire trails, 658 miles new construction and 777 miles repaired or improved.

Other major classifications in the construction category of WPA operations include 19,254 public building projects with 12,874 completions and 6,380 active; 7,667 projects devoted to parks, fair grounds and other recreational facilities with 4,946 completions and 2,721 active; 11,489 projects relating to sewer and water systems and other utilities with 8,086 completions and 3,403 active; 1,094 airport and other transportation projects with 573 completions and 521 active.



Top—Paving at Pleasantville, New Jersey
Middle—Farm-to-market road, Virginia
Bottom—Farm-to-market road, South Carolina

The following tabulation gives a complete breakdown on all construction projects together with their status:

In addition there were educational, professional, goods and recreational projects.

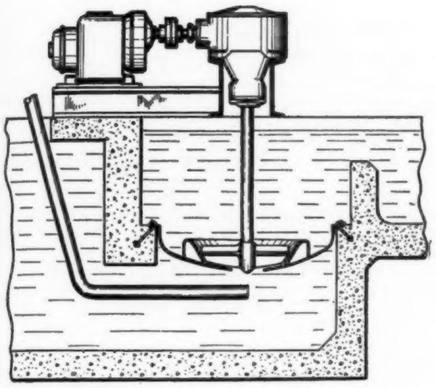
Total WPA Construction Projects, Beginning of 1937

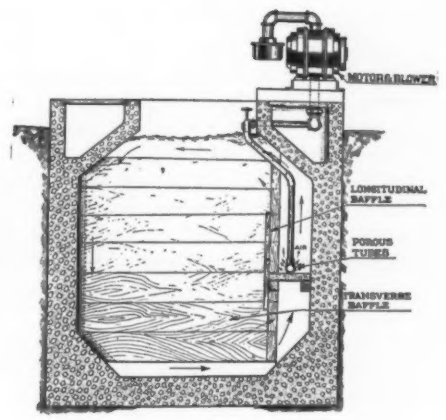
Type of Projects	*Total*	*Active*	*Completed*
Highways, Roads and Streets	*38,239*	*13,410*	*24,829*
Highways — primary roads	410	177	233
Farm-to-market and other secondary roads	16,177	6,013	10,164
Streets and alleys	8,085	2,529	5,556
Sidewalks, curbs, and paths	2,805	786	2,019
Roadside improvements	2,742	752	1,990
Bridges and viaducts	1,987	516	1,471
Grade crossing elimination	17	3	14
Other	6,016	2,634	3,382
Public Buildings	*19,254*	*6,380*	*12,874*
Administrative	2,754	874	1,880
Charitable, medical, and mental institutions	1,228	437	791
Educational	8,916	2,738	6,178
Social and recreational	2,363	937	1,426
Federal (including military and naval)	559	303	256
Improvement of grounds	2,446	698	1,748
Housing and demolition	43	9	34
Other	945	384	561
Parks and Other Recreational Facilities	*7,667*	*2,721*	*4,946*
Playgrounds and athletic fields	3,038	896	2,142
Parks	3,208	1,249	1,959
Other	1,421	576	845

Type of Projects	*Total*	*Active*	*Completed*
Conservation	*5,268*	*2,062*	*3,206*
Forestation	151	54	97
Erosion control and land utilization	371	130	241
Irrigation and water conservation	3,308	1,283	2,025
Plant, crop and livestock conservation	312	150	162
Other	1,126	445	681
Sewer Systems and Other Utilities	*11,489*	*3,403*	*8,086*
Water purification and supply	3,698	1,043	2,655
Sewer systems	7,106	2,133	4,973
Electric utilities	263	78	185
Other	422	149	273
Airports and Other Transportation	*1,094*	*521*	*573*
Navigation	193	83	110
Airports and airways	867	419	448
Other	34	19	15
Sanitation and Health	*3,124*	*1,894*	*1,230*
Elimination of stream pollution	117	59	58
Mosquito eradication	798	302	496
Other	2,209	1,533	676

Recent Use of Aluminum Sulphate in Sewage Coagulation

By W. A. Hardenbergh





At the left is the Dorr flash mixer, low-lift pump type, similar to equipment used at Ridgewood. At the right is the Link-Belt air agitated spiral flow mixer used at Liberty.

WHILE aluminum sulphate (commonly called "filter alum") is one of the older coagulants in use, it has until recently been neglected as a sewage coagulant. One of the first, if not the first, plant-scale use in recent years was at Liberty, N. Y., where its employment was suggested by Fred Stuart, and it was given a thorough trial by John Lawrence, Commissioner of Public Works, and Harry Eichenouer, operator, the writer cooperating in this work. The results were so satisfactory that further work has been carried on, principally by the General Chemical Co. It is now being used at Liberty for the third season, and it has been adopted tentatively at the new Ridgewood, N. J., plant where very good results have been obtained to date. It also is being used regularly in several other plants and is being tried out in some half-dozen others, under conditions varying from weak to very strong sewage, and also on industrial wastes with a BOD of as much as 1200.

In plant-scale use for sewage coagulation, aluminum sulphate has been shown to produce a clear effluent with reasonable dosages, and without the adjustment of the sewage pH with lime, acid or other chemicals.

Method of Feed.—Ground aluminum sulphate is used, fed by means of the ordinary dry feed machine having a water pot underneath. The resulting solution is carried to the point of application through an iron pipe or hose. Aluminum sulphate can also be fed by a solution feeder; and because of its ready solubility, even makeshift methods are possible, such as introducing it in a dry form directly into the sewage.

Point of Application.—In most cases best results seem to have been attained by applying the aluminum sulphate fairly near to the settling tank, since the floc forms readily and rapidly and is best allowed to settle without undue agitation thereafter. The floc does not appear to be of a fragile nature, however, and is not affected by the usual travel required in any well-designed treatment plant.

Methods of Flocculation.—Good floc has been obtained by the use of the Dorr flocculator, by air agitation, and also by around-the-end baffles placed in channels.

It appears that the Dorr flash mixer should be run at a low speed and that the flocculator also should be run slowly, as a larger floc which settles better appears to be obtained in this way. Probably a somewhat shorter mixing time than has generally been used in the past will give good results.

In the air agitator, good results are obtained by adding the aluminum sulphate about half-way through the agitation and mixing tank, and following a short period of rather violent mixing with a slow rolling motion, which can be produced by cutting down the air supply in that portion of the tank.

Around-the-end baffles can be placed in channels leading to the settling tank. Mixing of this type is used in many waterworks plants and the general method employed will be similar. This consists of a turbulent flow followed by a period of conditioning during a quiet flow. It is not believed that this method of mixing is as economical as the use of the flash mixer and flocculator or the air mix. Its principal use is in trying out alum in an old plant without the expense of installing any special equipment except a dry feeder. Fairly satisfactory results are obtained by placing baffles or other temporary devices in the entering sewer, or at the grit chamber or bar screen.

However, over any period of regular operation, the saving in chemical obtained by more effective coagulation by the flocculator or air mixing apparatus will generally more than pay for such equipment, and better results in treatment will also probably be obtained. Aggregate experience on mixing is not yet sufficient to make rigid suggestions.

Dosages.—A dose of about 4 grains per gallon (576 pounds per million gallons) will ordinarily produce good results. More may be needed if the sewage is very strong or if a heavy dose of supernatant from the digestion tank is entering; but increases in strength of sewage do not require proportionate increases in dosages; in fact, the stronger sewages appear to require only

slightly more. In the Liberty, N. Y., plant which was, it is believed, the first to use aluminum sulphate regularly, the dosage varies from 500 to 700 pounds per million gallons, except at those times when supernatant and trade wastes (which include laundry, creamery and slaughter-house wastes) are entering. The sewage at this plant is quite strong, especially in the summer, ranging up to a BOD of around 600. At the Ridgewood, N. J., plant the dosage now being used is 80 p.p.m., or about 667 pounds per million gallons. This plant has only recently been placed in operation. The BOD of the raw sewage averages 200 to 250 p.p.m.

pH Correction.—In actual plant-scale work, aluminum sulphate has coagulated satisfactorily with sewages ranging from pH 5.4 up to 8.8 or 8.9. At the higher ranges, it may be economical to add sulphuric acid to reduce the pH. At Liberty in 1936, when the pH ran from 8.8 to 9.2 during certain portions of the day, the addition of each $1 worth of sulphuric acid reduced the cost of coagulation by $2.53. Within all ordinary ranges, aluminum sulphate appears to coagulate readily, forming an easily settleable floc without pH adjustment. This is one of the advantages of this chemical, another being the ease of handling and applying. No special or extra equipment is needed; it is not corrosive, either dry or in solution.

BOD Reduction.—Results in the reduction of BOD have been surprisingly good. Data available are still insufficient to make precise statements in this regard, but results so far at hand indicate a removal of more than 70%. Suspended matter is practically entirely removed and the effluent is uniformly without turbidity.

Information available from other sources and from research bears out the experience at Liberty that the use of aluminum sulphate (or of iron) does not affect the digestion of the sludge. Chemical coagulants, partly by removing more of the suspended matter and partly because of the bulky nature of the floc, increase the gross quantity of the sludge per million gallons of sewage.

Aluminum sulphate has no chlorine demand, and if a residual resulting from prechlorination (as for odor control) is in the sewage when it reaches the plant, coagulation with aluminum sulphate will not remove it.

Paving Extras Due to Ambiguous Specifications

In an action by paving contractors for extras consisting of brass strippings placed in the terrazzo pavement on the sidewalks and neutral ground of a street in New Orleans, paved under a written contract between plaintiffs and the defendant city, the Louisiana Supreme Court, H. W. Bond & Bro. v. City of New Orleans, 171 So. 572, held that the plans and specifications were ambiguous as to whether brass joint strips were extras. The city engineer having drafted the plans and specifications, they and the contract were to be construed against the city. It was therefore held that the plans and specifications did not call for brass strippings as means of separating differently colored materials, so that the contractors could recover for the strippings as extras. The city called in as warranty a public utility whose franchise obligated it to pave a portion of the street on demand of the city. It was held the public utility could not escape liability on the ground that there was no privity of contract between it and the contractors.

Costs of Constructing Swimming Pools

The costs of swimming pool construction are difficult to give as conditions vary so widely, especially on pools constructed with government assistance, as park work other than on the pool is often carried on at the same time, according to H. J. Kuelling and W. E. Jeffrey, writing in *Wisconsin Municipalities.*

The Platteville pool, operated for three years, is 60′ x 150′ with a depth varying from 3½′ to 9′ and has a frame bath house 84′ long; cost for wages, $13,788, or 51% of total cost; for original equipment, $1,819, or 7% of the original cost; for material $9,101, or 34% of the original cost; and $2,323 for other costs. This is a total cost originally of $27,031 to which was later added the filter cost of about $5,000.

The Lancaster pool, which has also operated for three years, cost for wages $10,589 or 59% of the total; $415.00 for equipment; and $6,964, or 39% of the original cost, for materials, a total cost of $17,960. This pool is 60′ x 130′ with a stone bath house.

The Boscobel pool, which is 50′ x 100′ varying in depth from three to ten feet and having a stone bath house 87′ long, cost for wages $15,403, or 64% of the total; equipment $1,753, or 7% of the total; for materials $6,993, or 29% of the total; and a miscellaneous cost of $160.00, making a total cost of $24,309.

These three pools which have operated each for three years, are of different sizes and of different construction. It will be noted that the material cost ran around one-third of the total cost. This same percentage holds true in the later pools built.

Income and Expenses of Platteville Pool for Three Years

	1934		*1935*		*1936*	
Incomes	*Each*	*Total No.*	*Each*	*Total No.*	*Each*	*Total No.*
Charge Single Adult Swim	$ .20	2042	$ .20	2785	$ .20	3894
Transferable Cards	1.00	47	1.00	41	1.00	46
Charge Season Adult Swim	3.00	86	3.00	45	3.00	50
CCC Camp—Boys		None		None	2.00	34
Charge Single Child Swim	.10	2167	.10	4196	.10	5845
Charge Season Child Swim	1.50	214	1.50	281	1.50	276
Summer School Students					1.50	50
Other Income		98.39		203.11		263.32
TOTAL INCOME		$1,349.49		$1,777.21		$2,379.70
Expenses						
Guards, Attendants and Supervision (including Caretaker)		402.37		727.38		917.26
Lights and Power		35.64		103.86		321.64
Chemicals		123.97		84.46		150.52
Water Expense		218.83		240.07		272.39
Repairs		None		109.72		11.97
Miscellaneous		312.41		370.09		497.10
TOTAL EXPENSES		$1,093.22		$1,635,58		$2,170.88
Maximum Attendance 1 day		812		642		997
Average Attendance 1 day		229		254		300
Total Attendance Season		12598		19095		27561
Days Operated		55		75		92

Loveland Municipal Power Plant Reports $61,257 Net Income in 1936

The annual report of Ray Smith, manager of the electric light and power department of the City of Loveland, Colo., for the year ending December 31, 1936, shows total operating revenue of $94,193 and operating expenses of $32,935, leaving an operating income of $61,257. Bonds in the amount of $25,000 were retired, interest of $4,500 was paid, $10,000 was transferred to the general fund of the city, plant investment amounted to $8,352, and a surplus of $6,184 remained after making some minor payments and adjustments. Only $50,000 of the original bonded indebtedness of $419,000 is outstanding and within two years the plant will be entirely out of debt. The plant was financed in 1925 by the issuance of $294,000 of revenue bonds and $125,000 of general obligation bonds or a total bond issue of $419,000. *Colorado Municipalities.*

Estimating Construction Costs for Road Stabilization

A REVIEW of construction costs from records of stabilization work in Indiana, Illinois, Michigan and Minnesota shows a remarkable uniformity, when the cost of aggregates is considered separately from the cost of addition, preparation, and admixing of the binder soil and calcium chloride. It has therefore been possible to compile graphic charts from which costs for varying widths and thicknesses of stabilization can be closely estimated.

Since the average costs for stabilization varied but a few cents a ton, exclusive of the aggregate, average figures were taken and combined into estimate charts, which are shown herewith through the courtesy of the Calcium Chloride Association. The size of the job will affect these estimates slightly, but improved methods and equipment will undoubtedly tend to lower them quite materially in the future.

The weight in tons is used as the unit for gauging quantities because the average unit weight of compacted stabilized material is pretty well fixed at 145 pounds per cubic ft. Simplicity is obtained by using the weight in tons rather than adding another variable, such as the cubic or square yard.

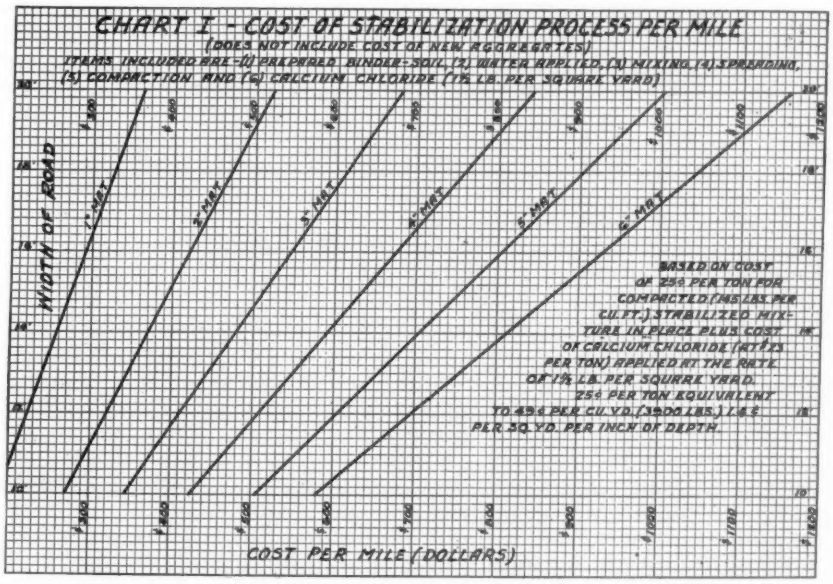
Costs include 1½ pounds per square yard of calcium chloride, which is figured at the average rate of $23 per ton. This may be used integrally in the mix or partly in the top dressing and partly on the surface, or all on the surface, without change in the estimated costs.

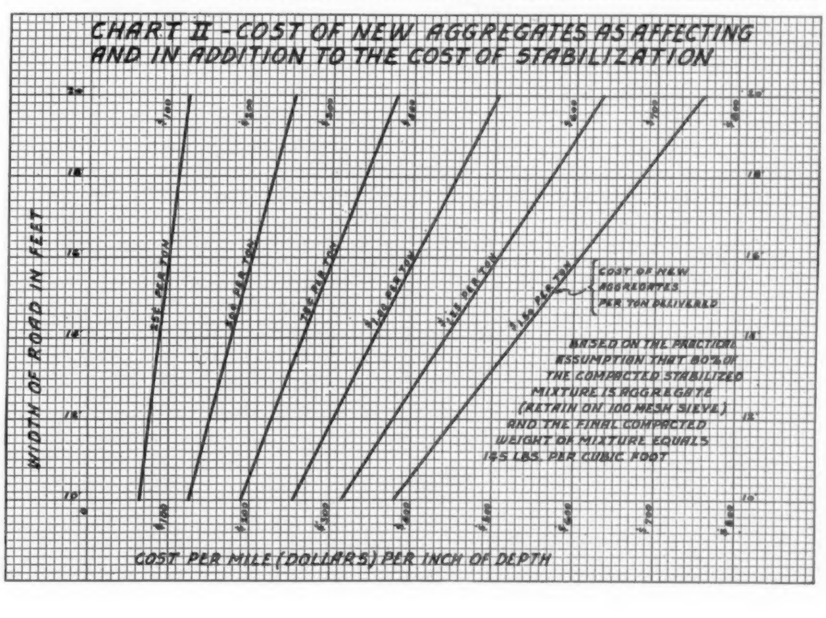
If it is desired to estimate the cost per mile of stabilizing the top 3 inches of an existing traffic bound road, which has not less than 3 inches of unstable aggregate on the surface, to a width of 20 feet, the procedure will be: Using Chart I, follow the diagonal for a 3-inch mat to its intersection with the horizontal for a 20-ft. width, and then follow the vertical line to the bottom of the chart. The approximate cost will be $680 per mile.

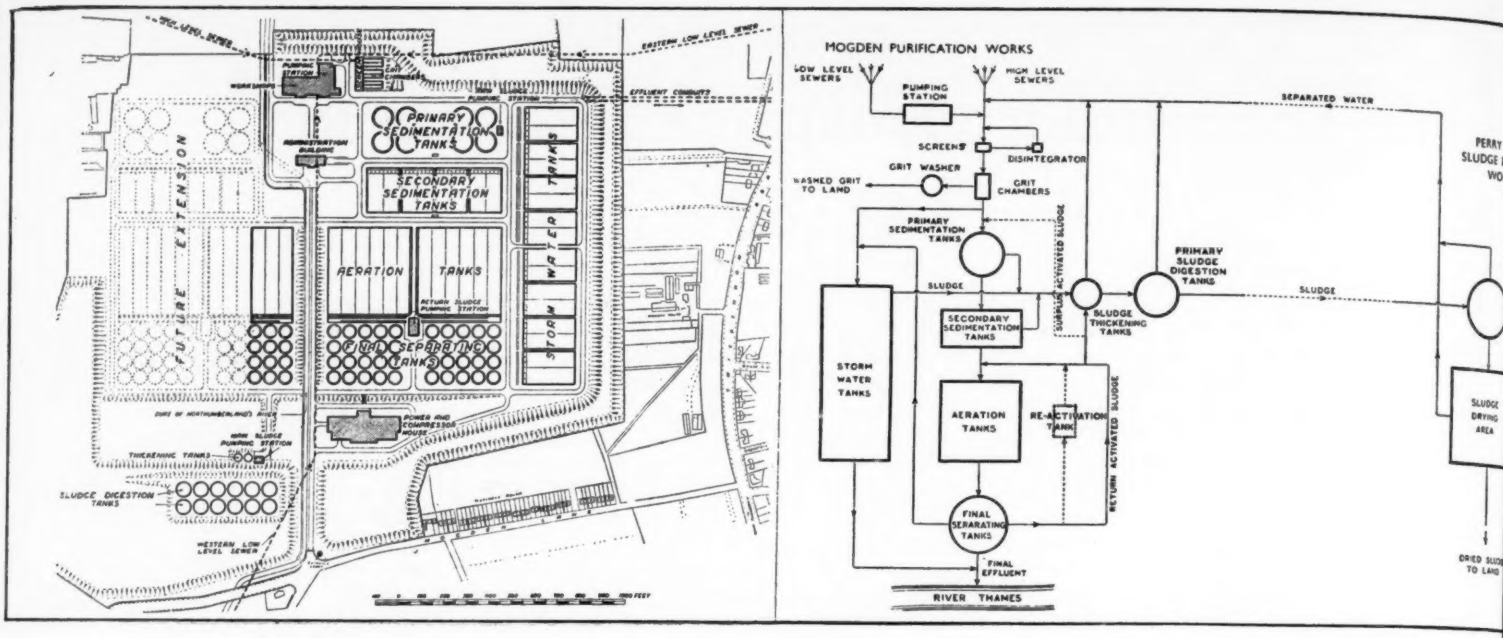
When new aggregate is needed, Chart II should be used to determine the probable costs for the extra aggregate. The new aggregate should then be added to the cost for stabilization to obtain the final probable cost.

To determine how much it would cost per mile to stabilize 3 inches of new aggregate, 18 feet wide, with aggregates costing 50 cents per ton delivered, the procedure will be: From Chart I, the cost for stabilizing a 3-inch mat, 18 ft. wide will be $615 per mile. From Chart II, the determination for the cost of new aggregate is made by following the diagonal for 50 cents per ton to its intersection with 18-ft. width, and then following the vertical line down to the bottom. This indicates a cost of $230 per inch of depth per mile for new aggregate. The depth being 3 inches, the cost for new aggregate will be $690 per mile, and the total cost for stabilization, plus new material, will be $615 plus $690, or $1,305 per mile. Since the aggregate costs 50 cents a ton, and its total cost will be $690, 1,380 tons of aggregate will be required.

Similar computations can be made where only a part of the aggregate required will be new material, as when it is desired to stabilize a 4-inch mat, and there are already 2 inches of unstable material on the surface. The cost of the new material, 2 inches deep, at the proper cost per ton, is determined from Chart II, and the cost of stabilizing a 4-inch mat from Chart I.







Plan and diagram of Mogden, England, sewage treatment plant. While not usually required, such drawings help in presenting clearly facts about a treatment plant

Preparing and Submitting Plans for Sewer Systems and Treatment Works

NEARLY all of the states require that plans and specifications for sewer systems and sewage treatment works be submitted to the State Department of Health for approval before construction. In some states, instructions have been issued for the guidance of the engineer in preparing data for submission to the state authority; in others there are no such regulations or requirements. But the observance of certain forms with the inclusion of all necessary data aids the State Engineers in forming a proper judgment and often saves delay in approval.

About a dozen states where instructions have been prepared outlining the method of procedure were asked to send us suggestions and information that might aid engineers in including all desirable information. Design data are not covered in this article.

Maps and Plans

While plans may be submitted for preliminary approval on blue-print paper, final plans are generally, though not always, required to be on cloth. Connecticut requires white paper or black cloth, but in most states white line prints on blue cloth are acceptable.

Pennsylvania does not insist on standard sizes or scales, and the same is true of many other states, but the following sizes should generally be adopted: 8½x11; 22x30; 25x38; and 22x70, which should be used for profiles only. The 22x30 size is regarded as standard and should be used so far as is practicable. On small jobs, a 15x22 may work out well. When the area to be covered is large, several sheets must be used, and an index is needed. Scales to be used are covered generally in another part of this article.

Preliminary Surveys and Reports

A careful and complete survey and the accumulation of full data regarding the amount, character and volume of the wastes to be treated are essential for the intelligent development of any sewerage project. Securing and compiling these data should be the first step to be taken up. A city should therefore first authorize these surveys and investigations, which should be combined in a preliminary report.

It is often desirable for the engineer to discuss with the state board of health those special problems that are brought to light through the medium of preliminary surveys and investigation. There are very few states that do not welcome such cooperation, which may reduce the work of the engineer in getting final plans approved.

In some states, for instance Illinois, information in the files of the department is available to an engineer who has been definitely engaged to make a study of this sort, and the department's laboratory facilities are also available for necessary analyses.

The preliminary report should aim to cover the following general items, and also any special problems: (a) statement of the problem; (b) present and future area to be served; (c) connected and design population data; (d) description of existing facilities; (e) present methods of garbage disposal and possibilities of future disposal with sewage; (f) character and volume of flow of sewage and of industrial wastes; (g) degree of treatment proposed and reasons therefor; (h) comparison of sites and types of treatment; (i) basis of design proposed for sewers and treatment units; (j) sketches and maps; (k) estimates of construction and operating costs; (l) methods of financing; and (m) general recommendations.

The above are adapted from information furnished by the Illinois Department of Public Health.

Preparing and Submitting Plans

Several states, notably Texas, Alabama, Ohio, Illinois and North Carolina, have prepared excellent instruction sheets to guide the engineer in preparing and submitting plans. Those of Texas follow:

Information Required.—The plans for a complete sewerage and sewage disposal system shall include:

A general map of the municipality or sewerage district.
Profiles of all sewers proposed.
Details of construction of manholes, flush tanks, and special structures pertaining to the sewers.
General and detail plans for disposal works.
A comprehensive report upon the proposed system by the designing or consulting engineer. This report to be typewritten upon lettersize paper, and the sheets firmly bound together.

A preliminary report, containing data and information sufficient for the complete understanding of the project, should be submitted to the State Department of Health, attention Public Health Engineering Division, for consideration, prior to the submission of detailed plans.

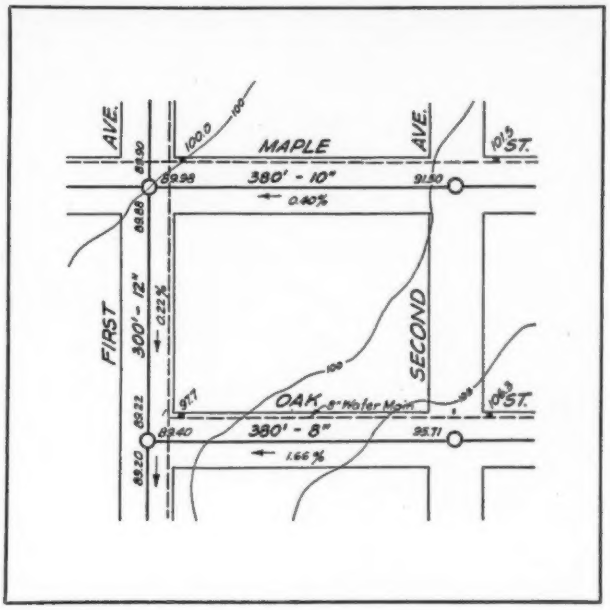
Map or General Plans.—The general plan referred to above shall be drawn to a scale not greater than 100 nor less than 300 feet to 1 inch, and shall show the entire area of the municipality or district. If the municipality is greater than two (2) miles in length the map may be divided into sections conforming in size to those mentioned hereafter. The sheets shall be bound together and a small index map supplied, showing by number the area covered by the various sheets. A general plan shall accompany each application, in the case of a new sewer system or any extension or modification of any existing sewer system, unless such general plan has already been submitted.

Details of Map.—This plan shall show all existing or proposed streets, the surface elevation at all street intersections, and contour lines at intervals of not more than five feet.

If it is intended to defer construction of sewers in some of the streets, the plan shall show that sewerage facilities are provided for all such sections of the municipality or sewerage district. The plans shall also clearly show the location of all existing sewers, the location of the disposal works, and the location of existing and proposed sewer outlets or overflows. The true or magnetic meridian, the town or city limits, title, date, scale, direction of flow, average water elevation, and high water elevation of the stream shall also be clearly shown. Any area from which sewage is to be pumped shall be shown by light shading, coloring, or other distinctive marks.

Lettering, Lines and Symbols.—Letters and figures shall be clearly and distinctly made, sewers to be built at present to be shown by solid lines, and sewers to be constructed later shall be shown by line of dashes, as: — — — — — — —. Existing sanitary sewers shall be shown by the following symbol: . . . . , and combined sewers by a dot and dash: .—.—.—.—.—. All topographical symbols to be the same as those of the United States Geological Survey.

Elevations.—Elevations of the surface of the streets to be placed outside the street lines in the upper right angle, or opposite their respective positions in the street.



Small section of a sewer map. Minnesota State Board of Health

The elevations of sewer inverts should be shown at street intersections, ends of lines and wherever a change of grade occurs. The elevations of the sewer shall be written close to the point to which they refer, parallel with the sewer line and between the street lines. The elevations of surface shall be shown to the nearest 1/10 foot; those of the sewer invert to the nearest 1/100 foot. The sizes and gradients of all proposed and existing sewers shall be marked along the line of the sewer.

Sewer Appurtenances.—All sewer appurtenances and unusual features, such as manholes, lampholes, flush tanks, siphons, pumps, etc., shall be designated on the plans by suitable symbols and referenced by a legend near the title.

Profiles.—Profiles of sewer lines shall be prepared and drawn to such a scale as to show clearly the structural features of the sewer. For ordinary use the following scales are suggested: vertically, 10 feet to 1 inch; horizontally, 100 feet to 1 inch. Both scales must be clearly shown upon each sheet. Upon these profiles shall be shown all manholes, flush tanks, lampholes, siphons, and stream crossings, with elevations of stream bed and normal water. Figures showing the sizes and gradients of sewers, surface elevations, sewer inverts, etc., should be shown with the same frequency as required for the map.

When grades lower than those given in the Recommended Practice are used, an explanation and reasons for the use of such grades should be included in the

Method of preparing sewer profiles, showing the data ordinarily required

engineer's report. On each sheet of profiles must be given, under the title, an index of the streets appearing on that sheet. Profile sheets shall be numbered consecutively.

Detail Plans

Sewers.—Detail drawings of sewer sections except where terra cotta or iron pipe is used, and of all sewer appurtenances, such as manholes, lampholes, flush tanks, inspection chambers, siphons, and any special structures, shall accompany the general sewer plans.

The detail plans shall be drawn to such a scale as to show suitably and clearly the nature of the design and all details, such as manhole frames and covers, iron pipes, valves, gates, etc.

Disposal Works.—The plans for the disposal works shall include a general plan upon which reserved areas for future extensions are clearly shown, and detail plans of the various units and structures which comprise the plant.

The detail plans shall show longitudinal and transverse sections sufficient to explain the construction of each unit. They should also show the distribution and drainage systems, general arrangement of any automatic devices, sizes of stone, gravel or sand used as filling material, and such other information as is required for the intelligent understanding of the plans.

Drawings

All drawings submitted shall be neatly and plainly executed and may be traced directly on tracing cloth, printed on transparent cloth or printed on any of the various papers which give distinct lines. All prints shall be clear and legible.

With the exception of the map, the following dimensions are suggested for ordinary use: distance from top to bottom, 20 or 30 inches; length, 24 inches, 32 inches, 40 inches, 48 inches, or 60 inches. By this section it is intended to prevent the use of unnecessarily large maps, which are difficult to file or use.

Each drawing shall have legibly printed thereon the name of the town or persons for whom the drawing is made, the name of the engineer in charge, the date, the scale and such references and the title as are necessary for the complete understanding of each drawing.

Engineer's Report

A report, written by the designing or consulting engineer shall accompany all plans for complete sewerage systems, and shall give all data upon which the design is based, such as:

For Sewer Systems.—(a) The nature and extent of the area which it is proposed to include within the present system of sewerage, and of the area which it is planned shall ultimately drain into this system.

(b) The population to be served, both present and estimated for 25 years hence.

(c) The estimated per capita daily flow of sewage to be cared for.

(d) The total and per capita consumption of the town at the present time.

(e) The allowance made for leakage into the sewers.

(f) The estimated daily flow of sewage, including leakage.

(g) The character of the sewage (whether domestic or including manufacturing waste, and in case of the latter, the nature and approximate quantity of the same stated in specific terms).

(h) Method of flushing or periodically cleaning the sewers.

(i) That portion of the sewers to be built at the present time.

(j) The minimum grades of sewers for each size used.

(k) If there are sections which cannot drain into this system, the extent of such sections and the probable future disposition of the sewerage from these sections.

(1) Distance of sewer outlet from shore and depth of water at mean tide at outlet, if outfall discharges into ocean or large stream. A list of bench marks or fixed elevations should be included in this report.

For the Treatment Plant.—(a) The method of disposal to be adopted and a description of the units of the system.

(b) The rate of working of each unit.

(c) If disinfection is to be used, the name of the disinfecting substance, the quantity per million gallons of sewage and the method of application.

(d) The name and nature of the stream or body of water into which the effluent discharges or may reach, with particular reference to the run-off during dry weather and after rainfall.

(e) The disposal of sludge.

(f) All conditions peculiarly characteristic of the locality and which in any way affect the design of the system.

(g) Special devices used in connection with the disposal system.

(h) Special methods of maintenance or operation of this system.

(i) The results expected from the purification system.

(j) Explain any provisions for reserve units in pumping plants, pipe lines, filters, etc.

(k) Provision for complying with Anti-stream Pollution Act.

(l) Consideration given in locating disposal works sufficient distance from homes or habitations.

Specifications for the construction of the system of sewers and sewage disposal works and an estimate of the cost of same shall accompany all plans for new or original systems. With plans for extensions of existing systems specifications may be omitted, provided that those extensions are to be constructed in accordance with specifications filed previously with original plans.

If the plans are solely for the extensions of an existing system, then only such information as is necessary for the comprehension of the plans will be required. This information must in general conform to the above requirements for a complete system.

Requests for Approval

In most states requests for approval of plans must be signed by some public official. Ohio data on the subject follow:

Plans shall be submitted in duplicate and shall be accompanied by (1) specifications in duplicate; (2) a report; and (3) a communication addressed to the state department of health, referring to the plans and making request for their approval. Such communication shall be signed by the proper public official in the case of a public improvement or if not an improvement to be made at public expense, by the person, firm or corporation proposing to install the same.

In the case of a municipality, the plans shall have received the approval of the council, or other governing body or managing officer of the municipality prior to their submission to the state department of health, and evidence of such approval shall accompany the plans.

If in an unincorporated community, a county sewer district, or other land in a county outside a municipality, the plans shall have received the approval of the board of county commissioners prior to their submission to the state department of health and evidence of such approval shall accompany the plans.

Road Rollers, Their Use and Selection

Buffalo-Springfield 3-Axle Tandem Roller

ROLLERS are an essential in almost every type of highway construction and maintenance. These are available in weights up to 17 tons; in the tandem, 3-wheel and 3-axle designs; and with gasoline or diesel power. Scarifiers are commonly attached to them; in some cases a scraper blade; and even some other extras.

Each of these rollers is designed for a special purpose, and to meet the peculiar needs of some type of construction and maintenance. However, very few cities or counties can afford to own a very large fleet of rollers; one, two or three is perhaps the maximum for all but the larger cities and counties. Townships, of which there are many thousands doing road work, are perhaps even more strictly limited in regard to numbers. The smaller communities will have to use a single size or type of roller for more than one type of work.

In surface treatment work, a 3-wheel roller is generally used, though a tandem is also suitable. Just after the cover aggregate is applied, the road is rolled once to imbed the aggregate particles, and then broom-dragging or brooming and rolling is continued until a firm, smooth and well-bonded surface is obtained. An 8 to 10-ton roller is desirable for this work, though lighter equipment may be used.

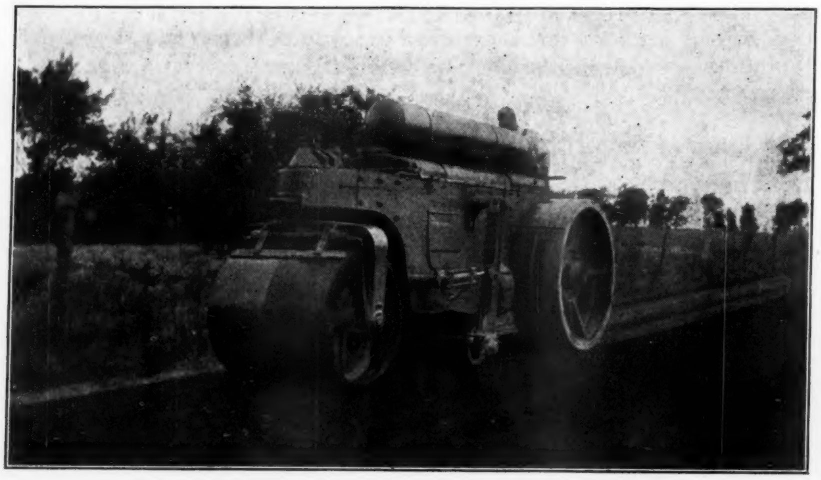
On road-mixes, a 10-ton roller is commonly employed when the mix thickness is 2 inches or more, but on thicknesses of less than 2 inches a 5 or 8-ton roller may be used. The weight should be sufficient to consolidate the surface and to key the particles thoroughly together. On this type of work, the 3-axle roller is particularly effective in obtaining a smooth riding surface, thus reducing traffic impact and thereby also reducing maintenance after construction.

These 3-axle rollers are made in two types. One type has, in addition to the conventional front and rear axles, a third axle, carrying a smaller roll. This can be raised for ordinary rolling, and the roller then is the same in all respects as the usual 3-wheel roller; or the third axle can be lowered so that the front roll, the rear rolls and the extra roll (which in some makes is placed between the front and rear axles and in others behind the rear axle) are all in the same exact alinement. This arrangement permits an added weight to be placed on the third roll, which has the effect of smoothing or ironing out high spots in the pavement surface.

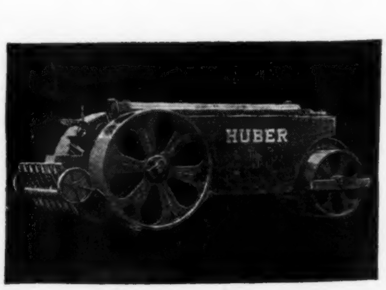
Another type of 3-axle roller consists of a 3-axle tandem, in which the transfer of weight is automatic as between the rolls. When a high spot is reached, the entire weight of the front roll is concentrated on it, and this is followed by the middle roll with about 50% greater compression.

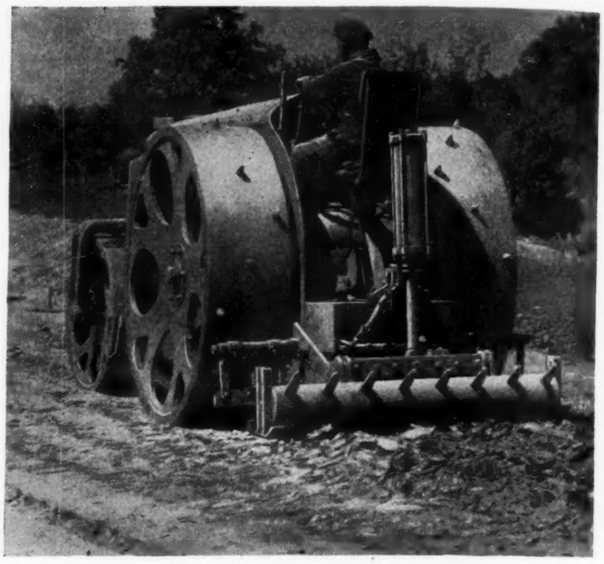
In order to obtain the best results from this type of roller—or from any other, for that matter—smoothness must be built and rolled into the subgrade, and into each course or layer of the pavement. No roller can be relied upon to iron out of the top surface defects due to careless construction of subbase, foundation or intermediate courses.

Bituminous macadam surfaces are often classified into three types. Type I involves the use of trap, hard



At the left, the Austin-Western 3-Axle Roll-a-plane. Below the 3-Wheel Huber roller





Galion Roller with Scarifier

limestone or granite aggregate, spread to a depth of about 3¾ inches and compacted to 2½ inches by rolling. This work requires a heavy roller—at least 10-ton and even 12 or 15-ton for very hard and tough aggregate. Key rolling, thoroughly done, is important because stability is obtained only by a complete interlocking of the aggregate.

Type II macadam methods are used where the rock is brittle and tends to break into clean, small fragments under rolling. The rollers used for this type of work need not be so heavy—10-ton equipment is suitable. Type III macadam involves the use of softer and more friable aggregates on which lighter rollers must be used to prevent undue crushing. An 8 or 10-ton roller is suitable for this work. Type II macadam is frequently carried on as a continuous job, and rolling of the stone after spreading and after each of the four applications of bituminous material, as well as after the seal coat, requires the use of several rollers. Generally at least three are required—one for key rolling, one for the intermediate work and one for final rolling.

Type IV macadam is constructed in several lifts or layers, each being compacted by rolling. For this type of work, the 3-axle roller is highly desirable and should be used in all stages of work including the subgrade. The weights of the rollers will depend upon the character of the aggregate, as explained under Types I and II, and will generally range from 10 to 12 or 15 tons.

Plant mixes, even when laid with modern spreaders and finishers, should be rolled to obtain complete compaction and for smoothness. A 3-wheel, 10-ton roller is commonly used, but tandems are employed on sheet asphalt types for diagonal and cross-rolling. The 3-axle rollers are valuable in obtaining smooth surfaces, through their ability to give increased pressures on high areas.

In stabilization with calcium chloride or salt, after the chemical has been applied and the road surface shaped with blade graders, it is rolled lightly; generally 3-wheel, or 3-axle rollers may be used of 8 to 10 tons weight. When bituminous materials are used for stabilization, a somewhat lighter roller is used—from 5 to 8 tons weight. On these types of surfaces, rolling should be continued for several days until roller marks are no longer visible on the surface.

In concrete pavement construction, rollers are commonly used for compressing the subgrade after fine grading and ahead of the paver. For this work, rollers of various sizes are used. The 3-wheel 10-ton roller is

perhaps most common, but various lighter weight special rollers, called "pup" or "pony" rollers, are often employed.

On brick and other block construction, rolling is necessary after the brick have been placed on the sand or mortar bed. Tandem rollers, 3 to 5-ton, are generally used for work of this nature.

Maintenance is an elastic term and may include surface treatment, or even resurfacing with road-mix. Rollers are necessary for maintenance work, except for making small patches, which are usually tamped in place. Sidewalks and similar light types of construction require the use of lighter rollers; a 2-ton maintenance and patching roller is available, and also one or more variable-weight rollers, in which the weight can be increased or decreased by filling the rolls with water or wet sand, or by emptying them.

In general, the township highway department will find two or three rollers necessary. The weight of the heaviest roller may depend on the character of the local aggregate; if hard and tough, a 12-ton roller may be desirable; otherwise an 8-ton and one or two 10-ton make a good combination. Counties, which cover a wider area, will need a larger fleet of rollers; depending somewhat upon the characteristics of aggregate used, there might be one 12-ton roller, two, three or more 10-ton, and one or more lighter units. The average city will need a tandem roller of 8 to 10 tons, and other units, depending on its size and the amount of work done, but not generally over 10 or 12-ton size.

Every road building unit, whether city, county or township should have a 3-axle roller, which becomes essentially a 2-axle when the third axle is raised.

Where a lighter roller is used than that most desirable, results nearly if not quite as good can be obtained by increasing the number of passages over the surface, say as about the third power of the weights. That is, two trips of a 10-ton or five of an 8-ton may give compression comparable to one trip of a 12-ton. But this may not always hold good, as when using hard, tough aggregate of large size.

German Data on Road Rollers

Modern types of rolling machinery in use in Germany vary from small 12-cwt. hand-guided single-wheeled models for the consolidation of footways to 25-ton three-wheeled steam rollers. Tamdem rollers (1.2 to 10 tons) are much used in the construction of bituminous surfacings, but the most widely used type is the three-wheeled Diesel-operated roller, varying in weight between 2½ and 18 tons. Rollers exceeding 18 tons in weight are steam-driven, but motor-operated, and especially Diesel-engined rollers, predominate amongst the lighter and medium types. Ease in manoeuvring and adaptibility to road cross-sections are secured by such means as differential gearing and adjustable rims, axles, and rear wheels. Many rollers can be operated at two or three speeds (¾ to 1.2 m.p.h. for single-wheeled units and 2 to 3½ m.p.h. for tandem and three-wheeled machines). Several modern machines are described with a tabulated summary of data regarding the number of wheels, working weight with and without ballast, h.p., dimensions, wheel-base, speed, effective pressure, and fuel consumption of a number of Diesel-engined rollers. Recent designs include a roller using producer-gas as fuel, and a three-wheeled roller with a suction unit that draws air into an oil-fired heating chamber; the heated air is discharged ahead of the rear wheels and utilized for the warming of bituminous surfacings. T. von Rothe: *Strassenbau*, 1937, 28 (5), 60-6.—*Highway Abstracts.*

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OVER AN OLD NARROW BRICK ROAD

This type of surface is also an excellent method of leveling and strengthening rough pavements of any other type.

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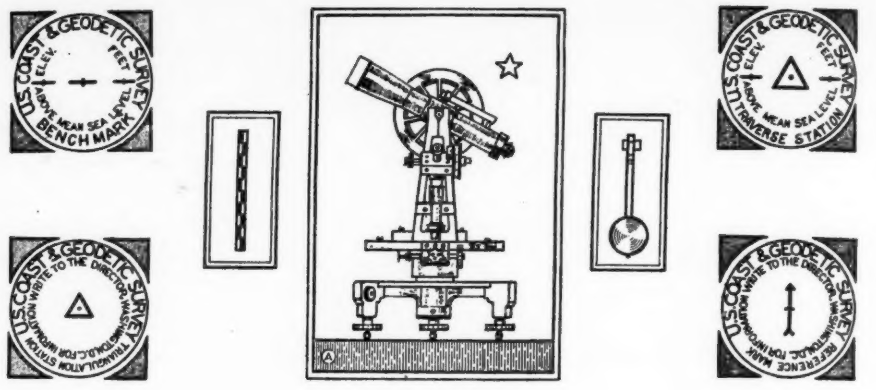


The three center figures are decorations used on the "Coast and Geodetic Letter"; the upper left cut shows the standard bench mark of the Coast and Geodetic Survey; lower left, triangulation station; upper right, traverse station and lower right, reference mark

By
H. S. SENSENEY
Topographic Engineer,
U. S. Geological Survey

Methods Used in a Topographic Survey of Denver

TO PROVIDE an accurate topographic map of the city and county of Denver, the Topographic Survey of Denver, Colo., technically known as WPA Project No. 674, was approved and authorized in November, 1935, by the Works Progress Administration. The project is sponsored by the department of improvement and parks of the city of Denver, and the work is being done under the direction of the United States Geological Survey. The engineer in immediate charge is Fred Graff, Jr., acting chief of the Rocky Mountain section of the Topographic Branch of the U. S. Geological Survey. The primary object of the project is to obtain an accurate and detailed large-scale map of the city; therefore its major efforts are directed toward the making of topographic surveys and the drafting and reproduction of the various sections of the map. The control surveys established as a foundation for the map, which constitute only a part of Project No. 674, are in charge of the writer, and the following remarks relate particularly to this part of the work.

The fact that the map will be the largest of its scale and kind thus far prepared by the U. S. Geological Survey has aroused considerable interest in the merits of various new methods of procedure. The result has been to introduce into this project many field and office practices not heretofore generally used in standard-scale mapping by the Topographic Branch of the U. S. Geological Survey.

About 60 square miles of territory are included within the corporate limits of Denver. To comply with the requirements of the city engineer's department it was decided to use a horizontal map scale of 200 feet to 1 inch, with a contour interval of 2 feet. On this scale the entire map would require 400 square feet of paper surface. A map of such size could not, of course, be produced in a single unit, so for the convenience of both the makers and the users of the map it will be assembled in 94 sheets, each representing a ground area measuring 4,000 feet from north to south and 5,000 feet from east to west. Units so shaped offer the greatest map surface on sheets that are not too large to be conveniently handled.

Horizontal Control

The plane-coordinate system of reference for horizontal control devised by Dr. O. S. Adams of the U. S. Coast and Geodetic Survey, and based on the Lambert conformal projection, was adopted by the U. S. Geological Survey for constructing the Denver map after carefully considering the advantages and possibilities of a number of alternate systems. The use of geodetic coordinates directly was at first contemplated, but as these are of little value to local engineers it was decided instead to use one of the systems employing plane rectangular coordinates. Four such systems were considered. A description of each follows:

1. A rectangular system based on a polyconic projection with either ground or sea-level distances.
2. A rectangular system based on some selected point of origin within the city. Similar systems have been used on a number of previous city surveys, and they are generally acceptable to local engineers.
3. A modification of the State system devised by the U. S. Coast and Geodetic Survey so as to use actual ground distances.
4. The State system devised by the U. S. Coast and Geodetic Survey without modification.

The last-mentioned system was the one accepted for the Denver project. In using it, all measured distances are reduced to their grid values in accordance with the Lambert projection, which is fully described in Special Publications Nos. 193 and 194 of the U. S. Coast and Geodetic Survey.

The State system of plane coordinates based on the Lambert conformal projection (No. 4, above) has been given considerable publicity, and has been legally adopted as standard in at least one State. It was adopted as a basis for the Denver map because it satisfies local and general needs and, at the same time, represents the most progressive ideas in modern large-scale map construction. In this State system, Denver falls within the central zone for the State of Colorado. The map angle, or variation between the meridians and grid lines, ranges from 16 minutes 41 seconds east on the west side of the city projection to 23 minutes 24 seconds east on the east side.

Before work on the project was begun there were available for horizontal control within the city, four auxiliary stations intersected from arcs of first-order triangulation by the U. S. Coast and Geodetic Survey. A number of intersected stations of the U. S. Geological Survey, established several years ago, were also available, but these were not considered as of sufficient accuracy to be included in a second-order control base. For the same reason a loop of traverse around the city,

established in 1933-34 by a project of the Civil Works Administration under the supervision of the U. S. Coast and Geodetic Survey, was not used as basic control. Computed points on this traverse line could not be recovered, and no information could be obtained either in regard to its circuit closure or as to the methods used in its computation.

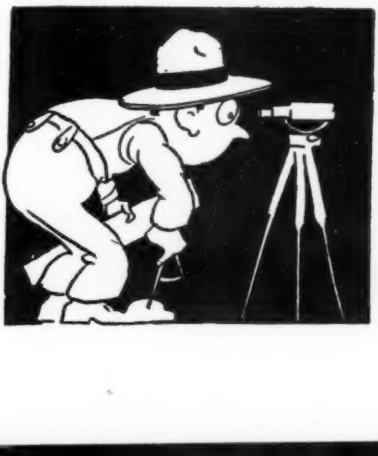
Obviously, this meager distribution of points was insufficient for the accurate mapping of so large an area. Further control was therefore established by combining additional triangulation with new loops of transit traverse.

Triangulation Net

A net of triangulation was first spread over the city starting from two first-order stations of the U. S. Coast and Geodetic Survey, Boulder and Morrison, located about 25 miles west of Denver. The triangulation was carried through to a tie upon two other first-order stations, Indian and Watkins, located approximately 15 miles east of Denver. The resulting net includes 21 occupied and 6 intersected stations, 19 of which are within the city proper. The diagram shows the arrangement and location of the triangulation stations that lie within the city limits. Stations Orphanage, Purine, and Tank are connected through triagulation with the first-order line Boulder-Morrison, and stations Fairmount and D. U. are connected with the line Indian-Watkins. This triangulation was used as a base from which to extend traverse control and it has been tabulated to give both the geodetic and the plane coordinates of each station. The instrument and signals were centered over the station marks at all stations. Angles were observed with a 10-second vernier theodolite by the repetition method, each angle being measured 20 times. The average closure of 41 primary triangles was 1.70 seconds, and the largest closure was 3.62 seconds. Adjustments were made by the method of least squares. The triangulation was computed first so as to obtain geodetic coordinates, which were then transformed to plane-rectangular coordinates.

The traverse net within the city limits contains 81 miles of trunk lines and 164 miles of intermediate traverse. Routes were first selected so that trunk lines would be spaced about 1½ miles apart. Intermediate lines, generally east-and-west, were then tied between the trunk lines at intervals of approximately 2,000 feet. The diagram indicates the routes followed by the traverse lines.

Slope distances were measured with 100-foot steel tapes, under 10-pound tension when along the ground and 22-pound tension if on supports. These tapes were checked every week by comparing them with a master tape which had been tested by the U. S. Bureau of Standards. In measuring distances each tape length was marked with a center punch in the head of a tack. The temperature readings and the differences of elevation at the ends of the tape were recorded for each tape length. All distances on trunk lines were determined by two independent measurements made in opposite directions. Mean distances were used for the computation. Intermediate lines were measured in one direction only. All measured lengths were corrected for temperature and inclination of tape, and then reduced to lengths consistent with the accepted projection.



Angles of the traverse were observed with 30-second transits, the deflection angles being measured six times by repetition. Closure errors for trunk and intermediate lines were within the limits prescribed for second-order accuracy.

Traverse stations were established about 1,500 feet apart, each one being marked with a spike and a chiseled triangle. Three reference marks were cut in curbs at each instrument station. Intermediate points at each street intersection along the lines were marked by spikes with chiseled circles around them. These traverse lines tied in and located 70 section corners and 142 quarter corners in the city.

Permanent marks were set along transit lines at intervals of about 2 miles. These marks are standard U. S. Geological Survey tablets in the tops of 8 by 12 by 48-inch concrete posts. The posts are usually set either in parks or between the sidewalks and curbs with their tops flush with the ground. In the Denver project 84 of these permanent marks and 3,291 intermediate points were established. It is safe to say that no street corner within the city limits is more than three city blocks from a located control point. The points are distributed in sufficient number over the 94 unit sheets to establish adequate individual control for each map unit.

Three astronomical azimuth stations were occupied and the observed azimuths were reduced to plane or grid azimuths. Plane azimuths at triangulation stations were used as initial or closing azimuths for the traverse lines. Traverses were computed in terms of rectangular coordinates. All trunk-line circuits were adjusted to the triangulation by computing mean values of coordinates at junction points. Intermediate traverses were generally fitted between trunk lines simply by prorating the required corrections according to their mileage. In the few places where junction points occurred among intermediate lines the usual trunk-line adjustment method was used. No attempt was made to adjust excessive errors, and in the 245 miles of traverse only 9.2 miles, or 3.8 per cent, of rerunning was necessary to bring all circuits within adopted limits of closure.

Tabulated results of the horizontal control, giving the x and y coordinates of marked stations, will be available to all engineers who have use for them.

Accurate lines of spirit levels were run over routes nearly the same as those shown on the traverse diagram. Bench marks established by this leveling are being used as reference marks for the vertical control of the topographic mapping. The bench marks will be useful also in determining mean sea-level datum for any local engineering surveys that may be made in the future.

First impressions of the standard State system of plane coordinates are apt to be unfavorable, but a careful analysis will convince those who use it of its many advantages over other forms of map bases for projects of the kind described and its merit as a standard base for all large-scale engineering maps.

This article by Mr. Senseney is from the "Geodetic Letter" of the Division of Geodesy, U. S. Coast & Geodetic Survey.

What Water Works Superintendents Think about Licensing

IN response to a questionnaire sent recently by the editor of this magazine to a selected group of waterworks superintendents, expressions of opinion regarding the desirability of licensing superintendents have been received from 346 of them. These superintendents represent all but one or two of the states, and all sizes of plants, and the opinions may therefore be taken as fairly representative.

Of the 346 superintendents responding, 198 or about 57½% are unqualifiedly in favor of licensing; 65 or about 19% were not in favor of it; 46 or about 13% did not care to express any opinion, and 37 or about 10½% were doubtful and wished to know more about the methods employed, the standards to be set up, or the details of administration. Various comments are given below, covering the divergent views.

In order to determine the reaction by geographical divisions, which it seemed might be interesting, the table herewith shows the number of replies from each section of the country:

Licensing Preferences by Geographical Divisions

Section	*In Favor*	*Against*	*No Expression*	*Doubtful*	*Total*
New England	13	12	7	6	38
Middle Atlantic	36	12	10	4	62
E. North Central	63	10	12	11	96
W. North Central	29	15	8	6	58
South Atlantic	14	6	2	2	24
E. South Central	10	4	1	0	15
W. South Central	11	0	1	1	13
Mountain	9	0	1	3	13
Pacific	13	6	4	4	27
	198	65	46	37	346

In New England, opinion was pretty sharply divided in all the states. In New York and New Jersey, two of the three Middle Atlantic States, opinion was preponderately in favor of licensing, but Pennsylvania was opposed nearly two to one. Most of the East North Central states were heavily in favor of licensing, but Michigan was fairly close, with 9 in favor, 5 opposed, 2 unwilling to state and 5 wanting to know more about it before committing themselves. Minnesota was 3 to 1 against licensing but the other states in that group were general in favor. In the other sections, Alabama and Virginia were opposed, but all the remaining states reporting pretty heavily in favor, as the results show.

Comments from our readers are given below as presenting both, or rather all, sides of the question. Names are withheld in order to permit of free statements of opinion. In general, these opinions have been selected from all parts of the country, and from both license and non-license states, to show the various facets of the question as it appears to superintendents.

"A Protection to the Public"

Says a southwestern superintendent: "If properly handled, licensing should be a decided protection to the public, particularly in small communities, which often have a tendency to turn the waterworks plant over to anyone who can run a pump. Licensing should also protect capable operators to some extent from political juggling." And from the same state: "If the licensing system is based on merit and has no political influences, it should prove a step forward in assuring the public of safe and intelligent operation by trained personnel." And still another: "Licensing is desirable to protect the public health from inefficient handling of the public water supply and to protect the men from being thrown out of their jobs due to political changes in administration."

A western commissioner says: "Many municipal waterworks such as ours are on a political basis, and the men in responsible charge of the entire water system—and also much of the other personnel—are changed every two to four years. This practice of educating new men and disrupting the operation continuity is very expensive to the taxpayers. A non-political licensed superintendent is vital in my opinion."

From the midwest: "A professional standing is given the water works man by licensing which will increase his interest in his work and his desire to improve himself. The city, of course, should be free to employ anyone provided he is a qualified man."

Another mid-west superintendent: "Licensing is needed in municipally owned plants to keep them from removing superintendents because they happened to be a Democrat or a Republican." In that particular state, political upheavals among superintendents have been shamefully frequent.

The following is quite representative of a number of replies: "Superintendents in municipal plants should pass civil service examinations, retain office under civil service rules, and be granted a pension when retired for old age or infirmities, the amount to depend upon years of service and payments into pension funds."

"I favor licensing water works superintendents, as it is just as important to have competent men in charge of water plants as it is to have competent men practicing medicine"—from the mid-west. Also: "It would be a God's blessing against politics."

"A Guard Against Politics"

"Licensing is a guard against political changes. It insures that a new operator at least has the confidence of the State Health Department. It takes the water department out of the political sports arena." And another: "I favor licenses, at least for cities of any size. This State has a law licensing treatment plant operators. I think it raises the quality and keeps politics from excessive interference."

Other comments in favor of licensing: "Licensing is badly needed here (in the west) to prevent, if possible, those political changes wherein nothing counts but friendship or what some one did in the last election. Licensing should be based in part on experience and in part on study, with provision for higher class ratings." And from the south: "I think that any man who takes a place as superintendent of a water department should know something of the nature of the work he is going to do."

"As a matter of principle, I believe in licensing all public employees holding positions of responsibility as an aid to more efficient service." "It would be well to license managers, superintendents and operators to encourage efficiency; and if protected by Civil Service it would prevent clean sweeps on the change of administration; but I have survived for 34 years."

"In fixing a minimum qualification for superintendents, licensing makes political manoeuvering with these positions difficult. This increases the standing of these positions and should gradually tend to get and keep better qualified men in them. It also adds to the protection afforded to public health."

This statement from Illinois is a sound one and summarizes the opinion of many who are doubtful as to how licensing will work out: "I advocate licensing if based on merit and not politics, and if licensing is in charge of competent authorities, preferably the Department of Public Health." That, also, is a compliment to Mr. Klassen, who seems to have the confidence of Illinois operators. Another man from the same state says: "Personally I am very much in favor of a serviceable licensing program for water works men and feel confident that such a licensing program would be enacted if the proper educational program were extended to the users of water and to men in the legislature." During the past three years, attempts have been made in Illinois to pass such a law, but have failed.

"Too Much Red Tape" and "Too Many Licenses"

And now the "Noes" have it: "There is enough so-called red tape in trying to make a living in this vale of tears, as it is. Why have more." "It is possible that practical experience in a small plant would be insufficient for formal examinations." "The State has too many licenses now to contend with." "It might be hard for a person who is not a graduate engineer to work up from the ranks." "Every step made toward the domination of a bureaucratic government over the acts and life of the individual is a step toward the tearing down of independence." "Do not think it is necessary in small communities, and men who are perfectly capable of filling such positions might have difficulty in obtaining licenses because of lack of education." "I do not believe licensing would add to the competency, as probably anyone desiring a license would be able to obtain it whether competent or not." "No advantage from licensing, especially if they are easily obtainable through political influence."

A southern superintendent voices briefly what seems to be an important point, and one that is responsible for many of the doubtful or contrary opinions, as follows: "No, because it will create a political license body which will make a superintendent a politician and not a competent waterworks man."

From a large southern city: "A superintendent is an executive and should be selected for executive ability, particularly required in the work he is to superintend. We cannot imagine any board being able to pass upon such abilities, nor do we know what examinations might apply." The same statement, in general, was made by a number of large cities, and it is clear that the business manager of a large city is in a somewhat different class than the actual filter plant operator or the superintendent of a smaller city. But another southern superintendent says: "The duties are not sufficiently specific in smaller cities to justify it."

From a mid-western state: "No, it would permit a monopoly of this work by engineers." And "No, because a lot of good practical water superintendents

have spent years in the management of their individual plants and are considered good men, but could not pass the examination for a license."

The present Wisconsin legislature defeated a bill for examination and registration of superintendents and operators of water works and water and sewage treatment plants, concerning which a superintendent of a large city says: "In the smaller towns and villages it may be necessary for the State Board of Health to exercise more direct control over men employed to keep the water supply safe, as many of them do not maintain their own laboratory; but in the larger cities, particularly those where these positions are under Civil Service, I feel that it is unnecessary for the State Board of Health to determine the fitness of the men employed to operate the water works or sewage disposal plants."

The Committee on Short School of the South Carolina Water Works Ass'n prefers their practice of issuing certificates to those who pass their course, leaving it to those who select the superintendents to require such certificates or not. Say they: "If the term 'licensing' means a permit to operate or supervise the operation, and the said license or permit is issued by any political board or committee elected or appointed by any political party, whether it be municipal, state or national, I am afraid the "licensing" will become just another political racket. For, in any political board or committee, favoritism and political pressure will cause many permits to be issued to those who are absolutely unqualified to hold such a responsible position. Efficiency can no more be legislated than morals or crime."

Many other interesting statements must be omitted. Those above show what and how superintendents think about licensing. We thank the many hundred who returned these questionnaires.

SERB Workmen's Compensation Case

A borough in Pennsylvania engaged in building a sewer, a work relief project, contracted with a pipe company for certain concrete sewer pipe. It stipulated that the pipe should be manufactured in the borough, using only relief labor allotted to construction of sewers in the borough. One of these relief laborers was injured by the dropping of a hopper of a concrete mixer. He was subject to the control of the borough's general foreman and his wages were paid by the State Emergency Relief Board. In compensation proceedings the Pennsylvania Superior Court held, Lamb v. State Work Relief Compensation Fund, 191 All., 916, that the laborer was at the time of the injury an employee of the State Emergency Relief Board and not of the pipe company (Lock Joint Pipe Company), which should not have been mentioned in the award.

Reduction of Bond Interest Rates Not Within P. S. C. Jurisdiction

The Pennsylvania Superior Court held, Blue Mountain Consolidated Water Co. v. Public Service Commission, 189 Atl. 545, that the defendant commission was without jurisdiction to require a public service water company to secure the approval of the commission before entering into agreements with the holders of its mortgage bonds for the reduction of interest rates, to be accomplished by delivery of the bonds to the company by the owners, the institution of lower interest figures, and the return of the bonds to the owners. This transaction was held not an "issuing of securities" within the statute conferring jurisdiction on the commission.

Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.

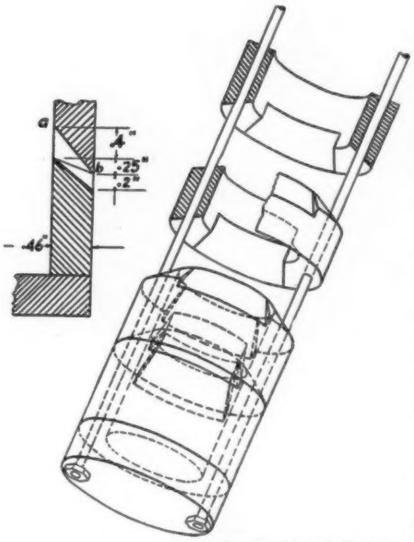
The Water Wheel

Gravel-wall wells, ten in number, built for Amarillo, Texas, water supply about ten years ago, have increased in capacity from 160 gpm to 700 gpm each, being back-blown about every six months. In development, about ten cars of 1/4" to 1 1/4" screened gravel was placed around the coarse screens of each well, and about 1/2 cu. yd. of additional gravel is placed with each back-blowing. In some cases the gravel traveled 28 ft. from the well during their original development. Later five fine-screen gravel-wall wells were built, which are not back-blown. These decreased from a capacity of 5 mgd at the beginning to almost complete choking in four or five months, but would open up on standing. At present, about 2 1/2 mgd can be pumped for about two months before resting.[J12]

Transite pipe has been investigated by a committee of the American Water Works Association, which describes how it is made from asbestos fibre and portland cement, and quotes (and apparently endorses) a report of the National Board of Fire Underwriters as follows:

"From the conclusions drawn it will be noted that it is practical to handle and ship the pipe and couplings and install and maintain them in underground piping systems; that systems constructed of them are not subject to rapid deterioration; that the pipe and couplings are capable of withstanding all reasonable stresses to which they are likely to be subjected under ordinary service conditions; that they are reliable in service; that they are uniformly made and can be uniformly assembled."[A98]

Transite pipe has been used for wells at Scituate, Mass., the screen also being made of short sections of such pipe, threaded on rods and provided with openings as shown.[G23]



Water Works and Sewerage.

"Transite" well screen

Removing corrosion products from metallic pipes can be effected inexpensively without damage to the metal surface by the use of inhibitors in acid solutions; these being certain organic materials such as aniline, pyridine, quinoline, certain coal tar products, bran, flour, glue or other. "The inhibitor, its concentration, working temperature, etc., should be studied carefully in the laboratory before being used in the piping system. Although the method has not been applied to the larger pipes in the distribution system, it is felt that such application is not at all impractical and offers an excellent field for research." The experiments cited were all on house plumbing.[A102]

Cooling water in Wichita, Kans., taken from private wells, was used for air-conditioning a number of buildings. A 10-story office building used it at the rate of 1.1 mgd or 4.785 mgd per acre. A theatre used 1,800,000 gals. during a 12-hr. period, the water temperature being raised from 68° to 82°. Homes cooling 1,000 sq. ft. of floor space full time use 10,000 gpd. Returning heated water to the ground to cool it and conserve the supply was not successful, as it was cooled only a very few degrees.[E19]

Chemical handling at the new Hammond, Ind., filtration plant embodies as many recent ideas and materials as possible, and is calculated to give wide flexibility of operation. Alum, the principal coagulant, may be fed to either raw water flume or outlet conduit of sedimentation basin (the latter to provide double coagulation). Ferrous sulphate can be fed with chlorine into a Transite pipe mixing chamber, and from this into the raw water. Lime can be fed into either raw water, sedimentation basin outlet or filtered water collector. Activated carbon can be fed into the raw water flume, sedimentation basin outlet, reaction basins Nos. 2 and 6 (for split feed), and settled water collector just ahead of filters. Chlorine can be fed to raw water ahead of raw water flume, filtered water collector, or the chlorine-copperas mixing chamber. Ammonia can be fed to either raw or filtered water ahead of the chlorine. Separate rooms for storing and feeding carbon minimize dust about the plant; and separate rooms for chlorine and ammonia can be closed from the rest of the plant and mechanically ventilated, have windows shaded to shut sunlight from containers and are heated by steam.[G21]

Lime for corrosion control apparently caused a gradual sluffing off of the tubercles which had formed in the mains and service pipes, temporarily increasing complaints of "red" water at Royersford, Pa.; but after several months the pipes apparently were cleared of tubercles. It is recommended that during the early period of this corrective treatment the lines be flushed thoroughly to remove this sloughed-off material.[G25]

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25. Meter Maintenance. By C. A. Gallagher. Pp. 816-819.
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59. Buffalo's Water System. By H. W. Fitzgerald. Pp. 671-673.
60. Lake Ice Cover Affects Buffalo Supply in Winter. By H. F. Wagner. Pp. 673, 683.
61. Sixty Years' Progress in Pumping Machinery. By W. H. Sears. Pp. 674-679.
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76. *p*. Design, Placing and Maintenance of Hydrants and Gate Valves. By C. S. Gruetzmacher. Pp. 851-852.

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Soap or Rubber in Road Tar

The drying time of road tar can be reduced by about 50 per cent by the incorporation of calcium soap in the proportion of one or two per cent, according to developments at the 1937 Congress of the International Association for Testing Materials held at the Institution of Civil Engineers, London, and described briefly in *Roads and Road Construction.*

As a demonstration, uniform strips of tar were placed on a piece of glass—one tar containing the aforementioned proportion of calcium soap and the other being a normal type of road tar. After various periods of exposure small particles of granite were sprinkled on to the surfaces and it could be seen that although after 46 hours the normal tar had not sufficient skin formation to prevent the granite particles embedding in its surface, the material containing the calcium soap had a hard, dry surface that gave no key to the granite dust after a setting period of only 22 to 26 hours.

Part of the same exhibit included evidence of the research carried out at Teddington on the blending of rubber with various types of tars. These experiments have been going on for about five years and it has now been found that chlorinated rubber is readily miscible with certain types of tars. Chlorinated rubber is an amorphous powder containing approximately 65 per cent of chlorine. It is marketed under the names of "Tornesite" and "Alloprene," and both forms of this chlorinated rubber, having dissolved readily, have been found to increase the viscosity of high temperature tars and, in addition, produced a novel rubber-tar substance possessing considerable elasticity which also has been found to adhere to granite, glass, etc., under water.

Exterminating Tree Pests

"Tent caterpillars" form unsightly colonies in roadside trees, especially in wild cherry. These may be burnt out readily with an air-acetylene torch equipped with a large size stem. Acetylene is supplied from a small portable tank, and 20 or 30 feet of hose is attached to a bamboo or other light pole. The torch is fastened firmly to the end of the pole. Operation is simple, and this method is superior to using flare pots or smudges because the acetylene flame can be controlled and used without injury to the foliage or bark. Such injuries are common when uncontrolled flares are used, and often results in dead branches the following year.

By burning while the tents contain caterpillars, best results are obtained, but even after no larvae are in evidence, burning is still worth while, both for appearance and because many cocoons are made in the tents, which should thus be burned before the moths have time to emerge.

A Digest of the Sewerage Literature of the month giving the main features of all the important articles published.

The Digestion Tank

Incinerators of sludge in use in several plants comprise two makes of the multiple-hearth, mechanically rabbled type. Others being developed are the "San-Dis" and "Buell." The former consists of rotating, horizontal drums for drying dewatered sludge cake, which are directly connected to furnaces and a final combustion chamber. The drums have screw vanes which, during the rotation of the drum, lift the sludge and gradually move it toward the burning grate, onto which it is charged mechanically. In the Buell type the sludge is dried in a rotary drum dryer, the interior of which contains a cruciform shelf structure which turns over and breaks up the sludge several times with each revolution, the sludge being mixed with previously dried sludge to prevent its adhesion to the shelves.[G22]

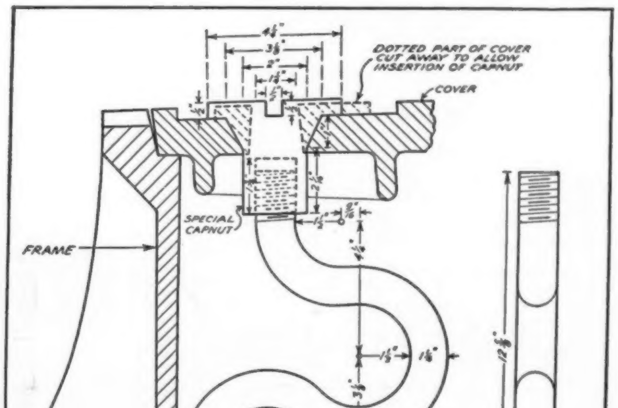
Grease removal was increased 189% to 442% by adding chlorine gas to the air applied in the grease skimming tank at Woonsocket, R. I. There aeration is provided during a 6-min. detention period, and for a week gaseous chlorine was introduced into the compressed air line feeding the diffusers. Less than 1.5 ppm of chlorine could be applied because of plant conditions; if more could be applied it was thought that the grease removal would have been even greater, although the removal ran as high as 29 pounds per million gallons of sewage (average for 24 hours). Much of this grease was from wool scouring. The method is to be tested this year on strictly domestic sewage at Baltimore.[G19]

Activated sludge experiments and tests indicate that sludge activity is the controlling factor in the activated sludge process; the rate of oxygen utilization of activated sludge-sewage mixtures is a measure of sludge activity and is readily measured by the odeometer; when activated sludge and raw sewage are first mixed the rate of oxygen utilization is a maximum and remains uniform for a period proportional to the strength of the sewage, then drops sharply and then more slowly until a point is reached where good purification and a well-activated sludge is obtained. The aeration period required to produce a well-activated sludge is inversely proportional to the maximum activity of the sludge and directly proportional to the strength of the incoming sewage. An activated sludge plant may be controlled on a rational basis by maintaining a maximum sludge activity consistent with the operating sewage strength, so that the sludge is in a well activated condition throughout the aeration period.[G18]

Activated sludge mixed with sewage clarified more rapidly and completely when aerated than when mechanically mixed; the latter resulted in higher bacterial numbers. "Clarification is a complex phenomenon brought about by a number of factors. The removal of inorganic colloidal material such as kaolin may well be the result of adsorption or ion exchange, while in the removal of sewage organic impurities, biological factors must be considered." "Sludge readily deflocculates under the influence of excessive agitation, or by agitation with nitrogen gas, and by washing." The character of the floc dispersed by washing differs greatly from the whole sludge floc; the volatile matter content of the dispersed floc in a well oxidized sludge is lower than that of the whole sludge, but may be nearly as high if the sludge is poorly oxidized.[C42]

Manhole explosions, causing lids to fly and endanger persons and property, can be prevented only by excluding explosive gases and liquids from the sewers; but manhole covers can be prevented from flying by providing venting slots occupying at least 50% of its area, or, preferably, by fastening them to the head casting by means of one or more curved bolts, which will straighten slightly and allow the cover to rise two or three inches.[J12]

Sludge pumps all have objectionable features. Valves in piston pumps fail to seat properly and wear rapidly; pistons wear and sludge squirts out at every stroke. Diaphragm pumps have valve troubles plus easily broken diaphragms. Centrifugal pumps wear between volute and impeller, where matches, hair and rags pack. Suction for digested sludge is fatal, for the vacuum releases the gas which kills the priming. When a screw feed cutting edges become dull, rags wind around it and the screw becomes an obstruction in the suction. For pumping sewage, vertical centrifugals give trouble in lubricating the vertical shaft in the bearings. There is no defense for a vertical pump if space is obtainable for a horizontal one. "The close-



The Single Curved Bolt which proved most effective for attaching existing covers to prevent flying

coupled horizontal pump and motor equipped with split sleeve babbit bearings, using oil for lubrication, is without doubt the most dependable, trouble-free unit." Bearings for all equipment should be split-sleeve babbit if possible; repairing ball, barrel and roller bearings is too complicated and expensive.[C44]

Ground garbage digestion was tested in 55-gal. tanks at Cornell University, mixing garbage and sewage sludge in proportions of 1 part of volatile matter in sludge to 1.5, 1.0 and 2 parts of volatile matter in garbage, the first being estimated to be that obtaining for the city of Ithaca. The general conclusion was that "As measured by volatile solids determinations or by gas production, either quantitative or qualitative, there appears to be no difficulty in the digestion of macerated garbage, either alone or with raw sludge in any proportion, in tanks seeded with well digested Ithaca sludge." At no time was there any foaming or any evidence of scum, possibly because the garbage and sludge were added near the bottom of the tank. The pH lessened at first, then increased to from 7.30 to 7.35 in each of the ten tanks. The cu. ft. of gas produced per pound of volatile matter added, varied from 10.19 to 10.70 for mixed garbage and sludge, 10.63 for sludge alone and 12.15 for garbage alone. The CH_4 content was slightly less for garbage than for sludge.[C39]

Experiments by the N. J. Agricultural Experiment Sta. to determine the effect of ground garbage on the clarification and BOD of effluents when chemicals are used for pH adjustment and coagulation, show that the addition of garbage may cause a greater or smaller removal of suspended solids. The quantity of garbage added equaled or exceeded the sewage suspended solids. The suspended solids in the effluent may not be increased by the addition of garbage, but the soluble BOD increases about 100%. Presettling of strong garbage-sewage mixtures may be of some help in clarification, but presettling of weak and average mixtures before chemical dosage is not of material aid and might be detrimental. The addition does not necessitate an increase in chemical coagulant proportional to the amount of suspended solids added. The ferric iron demand of garbage-sewage mixtures is greater than of sewage alone, but with alum coagulant it may or may not be greater. In any case, the addition of garbage causes only a small increase in cost of chemicals.[C40]

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P *Public Works*

June

27. 97 Per Cent Reduction of Pollution by Private Industry. P. 14.
28. c. Constructing Sewage Treatment Plant in Treacherous Ground. By O. J. Semmes, Jr. Pp. 15-16.
29. 35 Practical Suggestions for Sewage Plant Designers. P. 21.
30. Largest Sewage Treatment Plant in the World Nears Completion. P. 33.

Assessments for Joint Trunk Sewer

Two boroughs in Pennsylvania, Millvale and West View, and two townships, Shaler and Ross, entered into a contract for the provision of a joint sewer, fixing its size and location, and determining the shares of expense of construction to be borne by the respective municipalities. The contract also provided for a division of the cost of maintenance and repairs. The Pennsylvania Superior Court held: In re Borough of Millvale et al., 190 Atl. 546, that the benefits in the four municipalities could be assessed in one proceeding, the total of the assessment against individual properties in any one municipality being less than the share which such municipality agreed to pay. This was merely giving effect to the state statutes authorizing such agreements and therefore contemplating that the construction of a trunk line sewer might be undertaken and pursued as a single undertaking crossing the lines of the different boroughs or townships.

How Municipality Can Extend Its System Beyond City Limits

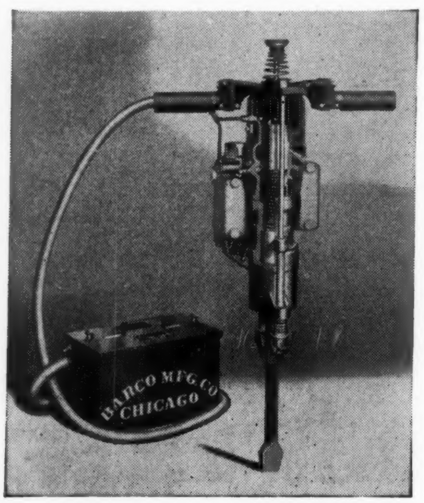
The Pennsylvania Superior Court holds, City of Lancaster v. Public Service Commission, 182 Atl. 781, that the extension of a city's water plant beyond the city boundaries authorized by statute may be made either by laying new mains, etc., in the adjacent territory or by buying an existing system or systems already connected with the city's mains, provided the extension is necessary or proper for the service, accommodation, and convenience of the public.

New Equipment

Fire Brick for Incinerator Lining

Following a two-year experimental period with insulating fire brick for incinerators, the City of New York has specified 2600 degree insulating fire brick in combustion chambers and flues because of the reduction of slagging to a minimum.

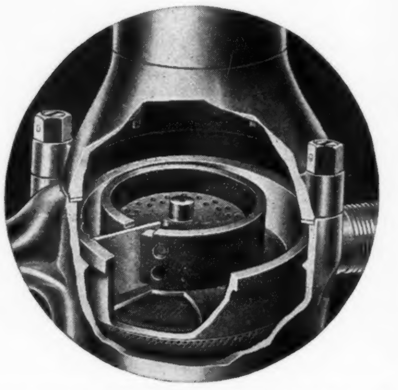
An installation was made two years ago of Armstrong's EF-26 brick in a combustion chamber in one of New York City's incinerators. The brick was used directly exposed in an area 16 feet by 12 feet and 9 inches thick. The bricks were laid and faced with air set cement and the results of the installation have been highly satisfactory. The brick has been found to be in excellent condition and newspaper ash has never slagged on the wall because of the low heat storage content of the brick. A ⅜ inch crust was the only deposit on the wall after the incinerator had been in operation several months and this crust was easily removed.



Above, new portable gasoline driven hammer, one of two new models. The heavy-duty, H-6, is used for pavement and rock breaking, drilling, driving piling, etc.; the light J-2 for continuous drilling. Barco Mfg. Co., Chicago, Ill.

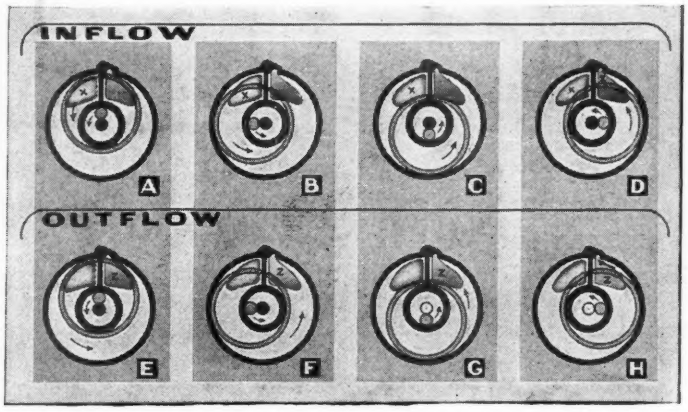
The Calmet Water Meter

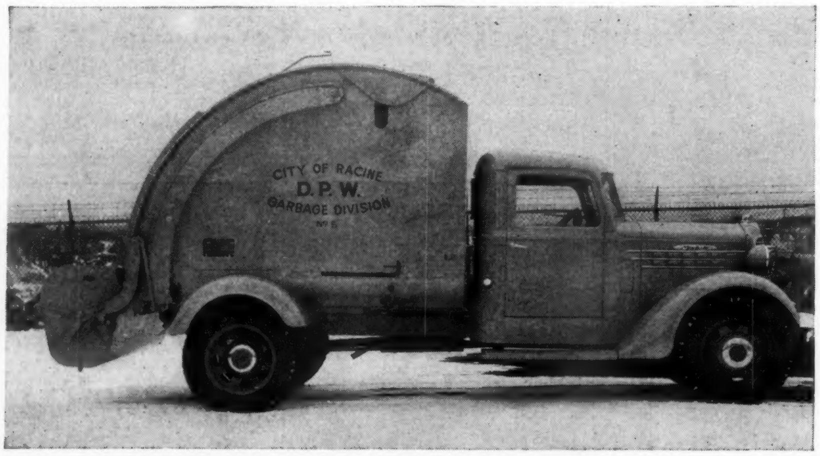
The Calmet meter is of the oscillating-piston type, that is the meter measures by filling and emptying the measuring chamber at each oscillation of the piston. In the smaller illustration herewith is shown the piston, which is of the slow-moving type, with 256 oscillation per cubic foot of water in the ⅝-inch meter. The larger illustration shows how the Calmet meter works. The top four figures portray only inflow or filling, though actually inflow and outflow occur simultaneously at each position of the piston. In the top four views the filling of the measuring chamber through one complete oscillation is shown, while in the bottom four only the outflow or emptying of the measuring chamber is shown through a second oscillation.



A very instructive catalog has been published describing and illustrating this meter. It will be sent on request to the manufacturer, Well Machinery & Supply Co., Fort Worth, Texas.

Operation of Calmet Water Meter; above, how the meter works





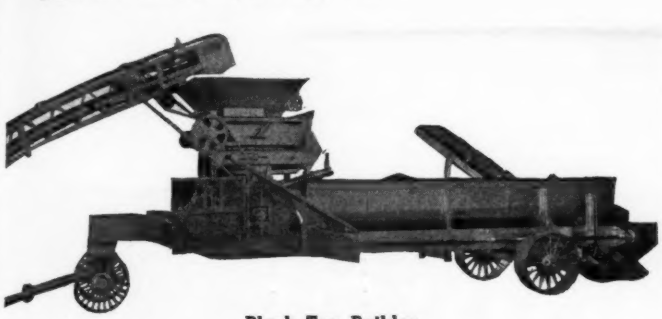
This radical departure from the ordinary garbage truck was recently placed in service by the Department of Public Works of Racine, Wisconsin. The truck is a Mack, Jr., with a 151-inch wheelbase. The body, 102½ inches long, 72 inches wide, and 63¾ inches high, constructed of plate welded high carbon steel and watertight was furnished by Heil. Equipment includes a power loading bucket, hydraulically operated, into which the garbage is directly loaded. This bucket then hoists the refuse up into the body. Operating in the vicinity of Racine and over a route which averages 50 miles per day, this truck hauls 8 cubic yards of garbage at a load

Fairbanks-Morse Small, Heavy Duty Diesel

A new Fairbanks-Morse Diesel, the Model 42-E, has been developed to meet the demand of small power users for a heavy-duty, continuous-service stationary engine. It is available in two- and three-cylinder combinations with ratings of 60 and 90 horsepower at 450 r.p.m., and can be furnished for direct-connected, belt or electric generator drive.

With an 8¾-in. bore and 10½-in. stroke, this Diesel is smaller and lighter than the F-M Model 32-E, but it embodies the features of the larger engines. It is small enough to be installed where space and head room are limited, and it is applicable for any power requirement within its ratings.

Further details regarding this new F-M Model 42-E Diesel are given in a bulletin available on request from Fairbanks, Morse & Co., 900 S. Wabash, Chicago, Ill. Photograph at right.

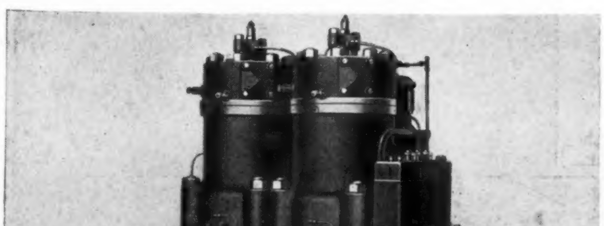


Black Top Builder

This shows the new Cedar Rapids "Rapidmix" plant with feed conveyor at the left and truck loading delivery conveyor at the right. Capacity 80 to 100 tons per hour. Weight only 9 tons. Handles all types of bitumens, under simple but accurate controls. Plant utilizes tractor or other power through takeoff drive (60 to 75 h.p. required). Bulletin RM 1 gives details. Iowa Mfg. Co., Cedar Rapids, Ia.

In the background, a P&H 355 convertible excavator which drove a pile every 10 minutes on San Gabriel River Bridge, Calif., for J. Strona, contractor. In foreground, P&H 150 bantam used to dig footings, etc.

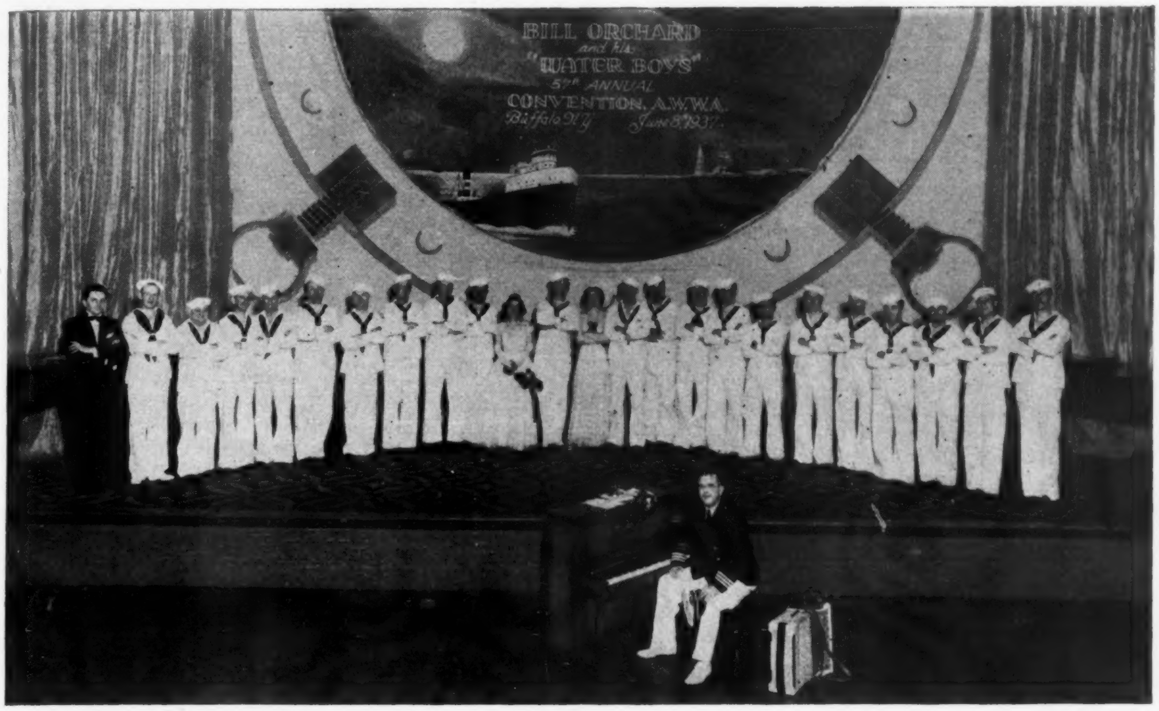
This blueprint hanger will hold up to 75 maps or prints. Hook turns down so that prints may be rolled for carrying. No loosening or falling out; no projecting parts to mar prints. Any size 12" to 48". Wade Instrument Co., Cleveland, O.



Fairbanks, Morse Small Diesel Engine

How to Design and Build SMALL EARTH DAMS

Send 30c in stamps or coin for this handy 24 page illustrated booklet on earth dam construction. Covers: Primary Factors in the Design and Construction; Spillway Capacity and Runoff Estimates; Materials for Construction; Construction Procedure. The booklet is a reprint, in handy pocket size, of articles published in PUBLIC WORKS within the last 13 months. Book Dept., PUBLIC WORKS, 310 E. 45th St., New York, N. Y.



Mr. Orchard at the piano; in the photo (not in the order named) are Clinton Inglee, George Haggeter, Edward J. Reilly, Joseph Wafer, Jack Butler, George Norcom, Charles Ramey, R. C. Totten, George Sopp, Harry Sloat, A. Lionel Gardner, J. L. Egold, Mrs. Linn Enslow, Anna Reichl, Allan Parado, Francis J. Brown, James Hamilton, Albert Boyle, Leo Boyle, William Grotz, Donald McCarthy, Harvey Yates and Clinton Hendler. Charles H. Eastwood, Robert T. Browning and A. T. Cirino, who acted as technical staff, are not shown.

American Water Works Association

The Buffalo convention of the American Water Works Association, held June 7 to 10, was one of the finest in the 57 held so far. The attendance was 1,140, increase of considerable size over any recent meeting, and of about 70% over the 1933 low. The 1938 convention will be held in New Orleans, La., during the week of April 25.

Eugene F. Dugger, general manager of the Newport News, Va., Water Works Commission, was elected president. Honorary memberships were awarded to William J. Orchard, Wallace & Tiernan Co., to Thomas Brooks, William W. Brush, Ross L. Dobbin and William M. Rapp. Abel Wolman, who has been appointed Professor of Sanitary Engineering at Johns Hopkins to succeed the late John H. Gregory, received the John M. Diven Medal as the member rendering the most outstanding service to the association. The Goodell Prize for the most notable contribution to the science or practice of water works, was awarded to Harry Hayes, Jr., and Laurence Goit. These awards were mentioned in the March, 1937, issue of PUBLIC WORKS. The Indiana section won the Hill cup for increase in membership, and also the Henshaw cup for members in attendance at the section meeting.

In winning the Hill cup, the Indiana section showed a membership increase of 31.9%, with New York 23.2% and New Jersey 16.8%. The winning percentage for the Henshaw cup was 90.3, with Montana second with 82.5%, Minnesota third with 82.3% and Rocky Mountain fourth with 81.8%.

The technical sections and the exhibits were both excellent. The former appeared to be unusually well attended and there was some lively discussion. The All-Division dinner was, as usual, the high point of the meeting. Under the direction of William J. Orchard the entertainment was unusually fine. There is no doubt that this entertainment, which is given by waterworks folks, is an important factor in attendance and morale. The announcement was made by Mr. Orchard, following the dinner, that after this, his twelfth season in charge, he would retire as leader of the entertainment. Undoubtedly there are others who can do a fine job, but he will be very greatly missed, and it is to be hoped that he will reconsider.

Underwood & Underwood, Washington, D. C.

Eugene F. Dugger, new president of the American Water Works Ass'n

Another View

Like the one-eyed drunk at the five-ring circus, we couldn't take it all in! But a host of fine impressions struck and stuck. Beginning with the moment that the Water Works Special from New York rolled into the Buffalo Terminal and continuing until the last straggling exhibit was trucked out of the Statler. (We didn't say *exhibitor!*)

For many the occasion harked back to the last previous convention in Buffalo, some 10 years back. With a favorable comparison instantly drawn. If Buffalo needed to learn anything as host in the years between, Alan Drake had learned it well.

Of course, conventions are not for the cynic. Bringing nothing, he gets nothing. But for the every day or garden variety of water works man and the manufacturers who serve him they present an unbeatable opportunity for men and minds to meet. Two men, each with an idea or an experience meet there; and each goes away with two ideas or two expe-

riences where but one had grown before. Multiply this by the hundreds of men in attendance, and you have something. Especially in a meeting so well balanced as the Buffalo one was between business and pleasure, serious thinking and serious dr— but our typewriter slipped there. We saw only the thinking.

Everywhere was evidence of behind-the-scenes thoroughness of planning. This was whether the detail was one of programs or entertainment or exhibits or transportation. And the friends we saw again! John Warde showing the railroads how to haul 'em. Charlie Becker handling exhibitors with a finesse that reminded us of John O'Leary in the years a-gone. Charlie Eastwood, proud of the publicity that brought attendance to high-water mark. Clarke Cassidy of the golfers, John Kienle, suave secretary of the manufacturers association . . . and, speaking of that organization, they had the liveliest meeting, with the most continuous flow of comment from the floor, that we have ever known that august body to pull off! With our hat off to President Fishwick for his parliamentary powers. And if he wore a couple of inches off the lower end of his gavel in exercising them, it was worth it!

Exhibitors, too, aroused our admiration; 81 shared the honors, with a camera practically necessary—for deciding the winning exhibit. For bunched at the finish-tape the naked eye took in Armco, Barrett Company, Johns-Mansville, Mueller, U. S. Pipe, U. S. Steel, Wallace and Tiernan; merely to name a few. With a host of others so closely at their heels that a cigarette paper could scarcely be thrust between. The McWane Pipe Company map was also on the map there.

But for the climax of it all we nominate Bill Orchard and his water boys—and girls. Here at the All-Division dinner on Tuesday evening, June 8th, Commodore Bill reached an all-time high (to date, we mean: he gets better every year!) As an impresario he was truly tops. With the aid of artists from the waterworks association ranks in Los Angeles, Buffalo, and New York he put on a musical show that would have done credit to Broadway.

And as, like men, the good that conventions do lives after them, Buffalo's can be looked back on as a starting point. If President Hurlbut struck a high note in his admiration, Eugene Dugger can be counted on to sustain it in his. We can but repeat what we heard all about us, "This is the best convention we have had in years."

New England Water Works Association

The 56th annual convention of this association will be held at the Poland Spring House, Poland Spring, Maine, September 21 to 25, inclusive.

The nominating committee has submitted as nominees for the coming year, the following: For president, Warren J. Scott, director, Bureau of Sanitary Engineer, Connecticut State Department of Health; for vice-president, Percy A. Shaw, superintendent and engineer, water works, Manchester, N. H.; for director, Harold L. Brigham, superintendent, Marlborough, Mass., Water and Sewerage Commission; for treasurer, Leland G. Carlton, Water Registrar, Municipal Water Works, Springfield, Mass. Frank J. Gifford, 613 Statler Bldg., Boston, Mass., is secretary of the Association.

American Road Builder's Assn.

The American Road Builder's Assn. Convention and Road Show will be held at Cleveland, O., Jan. 17 to 21, 1938. Charles M. Upham, National Press Bldg., Washington, D. C., is engineer-director.

National Asphalt Conference

The 1937 meeting of the National Asphalt Conference will be held in Memphis, Tenn., during the week of December 6. Subjects to be discussed include road building with asphalt, soil stabilization, flood control, harbor protection, airport surfacing and the building of safety into and alongside of highways.

The Association of Asphalt Paving Technologists will meet at the same time and place, probably for a 3-day session.

J. E. Pennybacker, Managing Director of the Asphalt Institute, 801 Second Ave., N. Y., will furnish information regarding these meetings.

PERSONAL NOTES

J. W. Kushing, for several years research and testing engineer of the Michigan State Highway Department, has joined the Highway Steel Products Co., Chicago Heights, Ill., as vice-president in charge of engineering.

Edward J. Mehren has resigned as president of the Portland Cement Association, with which he has served since 1931.

J. J. Summerby, assistant vice-president of Worthington Pump and Machinery Corp., Harrison, N. J., has been appointed general sales manager.

Henry Laughlin of Tyrone, Pa., has been appointed to the unique position of "water smeller" by the Industrial Chemical Sales Division, N. Y., and will devote his time to taste and odor problems of water supplies.

H. P. Pickering, formerly of the engineering department of the Santa Fe Railroad, and since then with the U. S. Bureau of Public Roads, has joined the Toncan Culvert Mfrs. Assn., Cleveland, Ohio.

The Central Foundry Co. has moved from 420 Lexington Ave., to 386 Fourth Ave., N. Y.

Hanson Excavator Works, Tiffin, O., have announced new dealers as follows: Boston, Mass., The Equipment Co., 30 Prentiss St.; Newark, N. J., Dale & Rankin, Inc., 113 Frelinghuysen Ave.; Hartford, Conn., Construction Equipment Co.; Utica, N. Y., J. Shuman Hower, 85 N. Genessee St.; New York, N. Y., R. C. Stanhope, Inc., 101 West 31st St.

Louis B. Neumiller has been appointed director of Industrial Relations, in charge of personnel, for the Caterpillar Tractor Co., Peoria, Ill. L. B. Fletcher has been appointed assistant general sales manager; C. M. Burdette has been made manager of the Central Sales Division; C. A. Spears manager of Allied Equipment Sales; M. T. Farley agricultural sales manager, eastern division; and Floyd E. Rusher assistant sales manager of the central division.

PUBLICATIONS

Street Flushers:
E. D. Etnyre & Co., Oregon, Ill., have issued an excellent and instructive catalog describing their street flushers and pressure sprinklers.

Calmet Water Meters:
A beautiful 18-page catalog, in colors, showing how Calmet meters work, and describing their construction in detail. Well Machinery & Supply Co., Fort Worth, Texas.

A 12-Ft. Power Shovel:
An excellent 24-page booklet describing the Austin Badger shovel and some of its many uses in highway and other municipal and public works construction. Austin-Western Road Machinery Co., Aurora, Ill.

Water Control Equipment:
Sluice gates of various types, with specifications; floor stands; shear gates; flap and drain valves; low pressure gate valves; check valves; and many other items are described and illustrated in this 48-page catalog of the Mueller-Columbian line. Mueller Co., Chattanooga, Tenn.

"66" Motor Grader:
This bulletin announces the new "66" motor grader, which is available with either single or double drive; blade width, 10 to 16 feet. Austin-Western Road Machinery Co., Aurora, Ill.

Testing Equipment:
A comprehensive description of the Southwark-Emery line of testing equipment is contained in this 48-page booklet, which is complete with charts, curves and other technical data. Baldwin-Southwark Corp., Philadelphia, Pa.

Motor Plows and Mowers:
An interesting 12-page booklet on the Gravely motor driven sidewalk snow plow, which will clear 40 to 54 ins. wide, and which is convertible into a motor driven sickle (cutter-bar) or rotary mower; also into a furrower or cultivator. Gravely Motor Plow and Cultivator Co., Dunbar, W. Va.

Readers' Service Department

CONTINUED FROM PAGE 56

These booklets are FREE to readers of PUBLIC WORKS.

Cast Iron Sewers

385. For use in wet ground to prevent infiltration, for crossing under railways and heavy duty highways, and for all other sewer construction where replacement, repairs or reconstruction would be costly, cast iron pipe is most economical. For details, specifications, etc., write Thomas F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Couplings for Pipe

386. This sixteen-page booklet is a reprint of a magazine article by a consulting engineer. It describes in detail the installation of a 42" water line; contains specific information regarding pipe joints, field organization, laying pipe, tests, back-filling, etc. Sent free by S. R. Dresser Manufacturing Company, Bradford, Pa.

Feeders, Chlorine and Chemical

387. For chlorinating small water supplies, swimming pools and other installations. Flow of water controls dosage of chlorine (or other chemicals) providing required dosages, which are immediately adjustable. Driving is started and stopped automatically. Send for newest literature. %Proportioneers%, 9 Codding St., Providence, R. I.

Fire Hydrants

388. Two new bulletins on M-H fire hydrants and fully bronze mounted gate valves are now ready. Contain full specifications and instructions for ordering, installing, repairing, lengthening and using. Write M. & H. Valve & Fitting Co., Anniston, Ala.

Gate Valves

390. 28 page catalog contains illustrations and complete specifications of M-H standard and extra heavy iron body gate valves, horizontal swing check valves, flanged fittings and flanges, etc. Sent promptly on request by M. & H. Valve & Fittings Co., Anniston, Ala.

Manhole Covers and Inlets

403. Nuisance from loose, noisy manhole covers is eliminated by the use of Westeel rubber cushioned manhole covers and gratings. Six special advantages are explained in a new illustrated bulletin just issued by the West Steel Casting Co., 805 East 70th St., Cleveland, Ohio.

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter, crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1¼ to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Pipe, 2-inch Cast Iron

407. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Steel

408a. A very complete, 60 page, illustrated bulletin on spiral welded pipe including lots of useful engineering information, hydraulic data, flow charts, specifications, etc., issued by American Rolling Mill Co., Pipe Sales Div., 1101 Curtis St., Middletown, Ohio.

Pipe Forms

409. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe Joints

410. New folder describes in detail a new type of pipe joint—the Dresser Compression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

411. A new bulletin has recently been issued giving full details concerning Tegul Mineralead, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

412. New plastic sewer pipe joint compound, Servitite, contains chemicals which positively prevent root growth and gives watertight joint. Get complete information from Servicised Products Corp., 6046 West 65 St., Chicago, Ill.

Taste and Odor Control

413. How, when, and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

414. Information on activated carbon for taste and odor control including data on operating experiences. Write L. A. Salamon & Bro., 216 Pearl St., New York, N. Y.

Pumps and Well Water Systems

415. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Protective Pipe Coating

416. Coal-tar Pitch Enamels for exterior and interior linings for steel water lines; highly resistant to water absorption, soil acids and alkalis. Technical specifications for materials and their application will be sent on request. The Barrett Company, 40 Rector St., New York, N. Y.

Pumping Engines

417. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Run-off and Stream-Flow

420. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

421. The simple, automatic Laughlin self-cleaning, traveling screen is fully described in an interesting bulletin issued by Filtration Equipment Co., 10 East 40th St., New York, N. Y.

423. Be asurred of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straight-line Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago, Ill.

Setting and Testing Equipment for Water Meters

424. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Rainfall Measurement

429. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons, Baltimore, Md.

Screens

430. Water Screen Book No. 1252, describes traveling water intake screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sludge Incineration

438. A multiple hearth furnace which meets the most exacting municipal sanitary requirements for the incineration of sewage sludge—produces a fine ash or partially dry sludge for fertilizer—is described and illustrated with drawings and photographs in bulletins issued by Nichols Engineering and Research Corp., 40 Wall St., New York, N. Y. Operation as well as installation data is given.

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Swimming Pool Equipment

444. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 214 West Huron St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

448. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

452. Eliminate sludge bed troubles, forget about weather conditions, odor nuisance, hail insurance and the like. Full details as to how Oliver United Vacuum Filters overcome these problems will be sent to all interested by Oliver United Filters, Inc., 33 West 42nd St., New York, N. Y.

453. How to avoid sludge and scum troubles in settling tanks explained in detail in Book No. 1542—has excellent drawings and photographs, also specifications. Most important are the carefully prepared capacity tables. Link-Belt Co., 307 N. Michigan Ave., Chicago, Illinois.

454. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 570 Lexington Ave., New York, N. Y.

Thawing Equipment

460. Complete details concerning this quick-acting, efficient, electric pipe thawer which sells for only $39.25 complete, will be sent promptly by Commonwealth Mfg. Corp., Dept. P-710, 3785 Beachmont Ave., Cincinnati, Ohio.

Water Works Operating Practices

490. This is a reprint of two excellent papers by F. E. Stuart. One outlines a number of filtration and field practices of value. The other presents a lot of kinks the author has picked up in visits to more than 1,000 water works plants. Sent free by Activated Alum Corp., Curtis Bay, Baltimore, Md.

For the Engineer's Library

Brief reviews of the latest books, booklets and catalogs for the public works engineer.

Aeration of Sewage and Water:

Air is applied through porous diffusers for activated sludge treatment, for sedimentation pre-aeration, for mixing in chemical treatment, for flocculation, grit washing, sludge mixing, elutriation, and other purposes. This 32-page booklet by Frank C. Roe covers the use of air in connection with these methods of treatment. Of interest to the engineer are: Capacity and form of tanks for aeration, air requirements, blowers, filters, piping and diffusers. There are drawings and illustrations, showing installations. Most of the worthwhile material available has been summarized in this bulletin. Sent on request to Carborundum Co., Niagara Falls, N. Y.

Taste & Odor Control:

This is a complete 78-page treatise on the use of activated carbon for taste and odor control in water production. It covers feeding methods, points of application, application to reservoirs, dosages and costs, establishing correct dosage, and gives helpful suggestions for use under normal and abnormal conditions. Also tells how a number of cities are using Nuchar, covers granular carbon filters and tells how to get uniformly palatable water. Appendices contain data on storage, conversion tables, photomicrographs, and information on physical characteristics of carbon. This book will be sent on request to Industrial Chemical Sales, 230 Park Ave., N. Y.

Health Protection of Welders:

A rather complete compilation of present-day information on health hazards connected with welding operations has been made by the Industrial Health Section of the Metropolitan Life Insurance Company in a report "Health Protection of Welders." It discusses the types of welding and lists four principal hazards that are encountered: (1) electric shock and burns, (2) radiant energy (roughly classified as ultra-violet rays, infra-red rays and visible light rays of excessive intensity), (3) gases, fumes and dust, (4) miscellaneous, which includes such hazards as the possible exhaustion of oxygen in the air breathed due to pollution by products of combustion in confined, unventilated spaces. These various hazards are discussed in some detail in the booklet and protective measures are outlined. Methods of treatment are also considered. Copies are available from the Policyholders Service Bureau, Metropolitan Life Insurance Company, One Madison Avenue, New York, New York.

Asphalt Reference for Highway Engineers:

To the already available booklets of this type is now added a 240-page pocket sized manual or reference book which has been issued by the Asphalt Institute. It has a flexible cover, is 3½ inches wide and 5¾ inches high. Written by Prevost Hubbard, chemical engineer and Bernard Gray, chief highway engineer of the Asphalt Institute, its 17 chapters contain a great deal of valuable data. Chapters include tests, condensed specifications, equipment, construction specifications for all types, bases, maintenance, bridge floors, track construction, tennis courts, sidewalks, playgrounds, airports, etc. This very excellent booklet will be sent on request to this magazine or to the Asphalt Institute, 801 Second Ave., N. Y.

Douglas Fir Use Book:

This is a 209-page book on the use of Douglas Fir. It is intended primarily for the use of engineers. Data and formulas must be used with a knowledge of basic engineering principles. In this brief review we cannot begin to tell all this book covers. What kind of timber for cribbing, what for scaffolding, what for sewer piling, highway bridges, guard rails, curbs, etc. These are indexed, 26 such uses in all, with data on the grade to be used. There are about 90 pages of tables of span-loads for joists and beams, and another 40 pages of similarly valuable data on related subjects. The text was prepared under the direction of C. J. Hogue, with the assistance of L. P. Keith, Irene Walker, H. J. Belch and Russell Mills. It is published by the West Coast Lumbermen's Ass'n, Seattle, Wash., and sells for $1.

Low-Cost Construction and Maintenance:

This text covers the following: reducing the loss of surfacing materials, principles of stabilization, partial or stage stabilization, stabilized bases for pavements, hints on maintenance, and shoulder maintenance. It will be sent on request to George H. Kimber, Solvay Sales Corp., 40 Rector St., N. Y.

Sluice Gates:

Koppers Company's Western Gas Division at Fort Wayne, Ind., has just published for free distribution a new sluice gate catalog containing detailed drawings, specifications and dimensions of gates in a wide variety of sizes for unseated and seated pressures. Sluice gate installations and operating methods also are shown in a series of diagrams, as well as diagrams and dimensions of floor stands.

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